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About Authors

● **H. M. Crane** (LM '12), president of the SAE in 1924, has seen many "new-fangled" ideas come - and almost as many go, since 1906 when he organized the Crane & Whitman Co., which later became the Crane Motor Car Co., and still later was consolidated with the Simplex Automobile Co. The Simplex company was absorbed by the Wright-Martin Co. in 1916 and Mr. Crane, who had been vice-president of the old company, became vice-president in charge of engineering, holding this position through the company's reorganization as the Wright Aeronautical Corp., resigning in 1920. For a period he rendered consulting engineering service and was engaged in the development of a new passenger car, then in 1925, he became affiliated with the General Motors Corp. as technical assistant to the president. In the SAE he has given considerable time to the work of the Society's technical and administrative committees. He is now a member of the Finance Committee, the General Research Committee, the Fuels Research Committee, and the CFR Committee. He holds B. S. degrees in mechanical and electrical engineering from M.I.T.

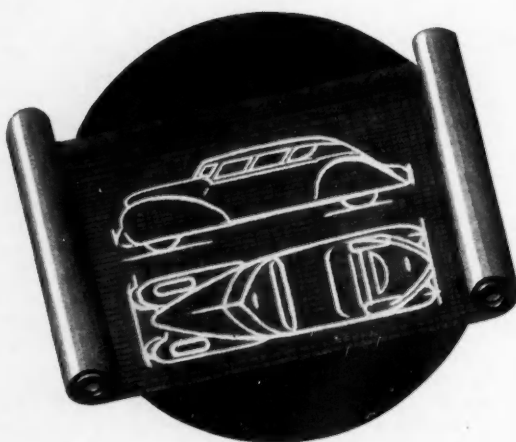
● **Jerome Lederer** (M '26) has specialized in aviation safety engineering as chief engineer of the Aero Insurance Underwriters since 1929. His work has been mostly of a pioneering nature, covering analysis of risks in connection with the insurance of airlines, test flights of new airplanes, private flying, industrial aid flying, and numerous other phases of aviation. He also is in charge of an extensive inspection service employing 170 selected men in various parts of the Western Hemisphere. Before taking his present position Mr. Lederer had erected and operated a wind tunnel at New York University and was aeronautical engineer for the United States Air Mail Service before that service was transferred to private interests. He received his B.S. in M.E. and M.E. degrees from New York University.

● **Neil MacCoull** (M '17) entered the automotive industry by working on designs for cycle cars immediately after re-
(Concluded on page 19)

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YOUR 1940 SALES FIGURES ARE IN YOUR DRAFTING ROOMS TODAY



HIDDEN in the ultimate plans and specifications of the cars on your boards today are your 1940 sales figures. It would take a prophet to interpret them . . . but there they are.

Of course you're giving the big job all your thought—exercising every precaution to make your 1940 position as near bomb-proof as you can make it.

And so is Bendix . . . focusing its energies to help make *your 1940 sales volume* the highest possible. Bendix exists to serve the whole industry, and has done a workmanlike job of it for many years. Today's headlined improvements, in large measure, started in Bendix laboratories.

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Dictators' Air Threats Being Met, National Aero Meeting Told

THREATS to the leadership of American civil aviation resulting from the aeronautical policies and practices of Italy and Germany are being resisted by the work and guidance of the Civil Aeronautics Authority, G. Grant Mason, Jr., a member of the CAA, reassured several hundred listeners at the banquet that climaxed the 1939 SAE National Aeronautic Meeting, held at the Hotel Washington, Washington, D. C., March 16 and 17.

Mr. Mason's speech lowered the curtain on the most ambitious program yet undertaken at SAE National Aeronautic Meetings. To crowd the 7 technical sessions, in which 12 papers were read and discussed, a factory inspection trip, a demonstration airplane flight, and the banquet, into two action-packed days necessitated 3 simultaneous technical sessions. The program was arranged by the SAE Aircraft-Engineering Activity Committee of which SAE Vice-President William Littlewood is chairman and the SAE Aircraft-Engine Engineering Activity Committee of which SAE Vice-President H. K. Cummings is chairman, with the cooperation of the Washington Section and its chairman, Col. Paul Weeks.

In Latin America, in particular, Mr. Mason sees our leadership challenged. "Italy intends inaugurating soon air services from Rome to South America . . . the Germans alone are operating over 12% more route miles in South America than our own carriers cover . . . the Germans and Italians have in-

creased their aircraft exports to South America many fold . . . the situation is further complicated for us by the barter arrangements and long-term credits of the dictator nations," he reported.

In answer to this menace, Mr. Mason explained, proposed beacons at strategic points in Latin America will permit night operations of American civil aircraft. Changes in schedules and additions in frequency will give better and faster service; tariff rates will be revised to promote greater travel over our routes; and the most modern and efficient airplanes in the world probably will be used on many of our airways between the American Republics.

Mr. Mason was introduced by Rear-Admiral Emory S. Land, who served as toastmaster. Before his speech the diners had heard Col. Weeks welcome the guests to Washington and a short talk by SAE President W. J. Davidson.

What a big difference a small thing like a projecting rivet can make in airplane drag when multiplied by 30,000 or more; comparison and evaluation of the many and varied ways to drive accessories; new methods of figuring wing-beam stresses; and a review of low-turbulence wind-tunnel development, were among the highlights of the Aircraft Sessions. Whether or not safety fuel and fuel injection were going to supersede gasoline and carburetors in American aircraft engines was the subject of sharp debate in one Aircraft-Engine

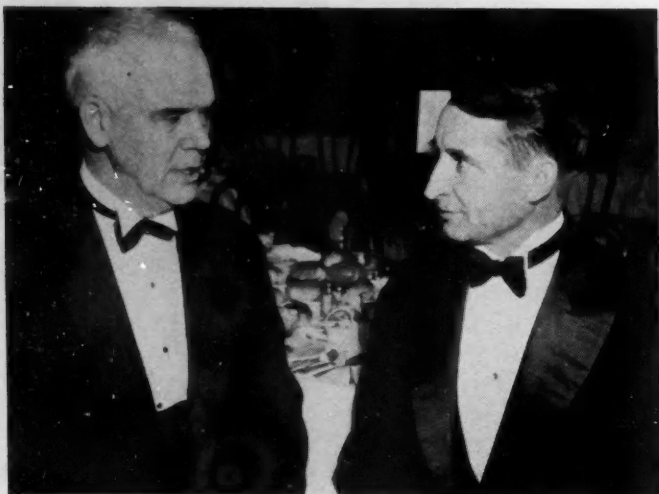
SAE 1939 Aero Chiefs

SAE Vice-President William Littlewood (left) representing the Aircraft Activity, and SAE Vice-President H. K. Cummings, representing the Aircraft-Engine Activity. Mr. Littlewood and Mr. Cummings not only headed up the Activities that sponsored this successful meeting, but also served as session chairmen on the first day.



(Photographs by Harris and Ewing)

Washington Section Hosts



Col. Paul Weeks, chairman (left), and C. S. Bruce, treasurer, of the Washington Section of the SAE

Session. In others, whether or not a rigid limit should be put on vibration amplitudes; how to make further gains in fuel economy; and how a torque meter can be employed to give precision power control in airline operation, were the subjects of discussion. A combined session was featured by actual pictures of ice formation on feathered propellers in flight and moving pictures of actual fuel-dumping tests.

Large Turnout for Inspection Trip

Over 100 traveled by bus and by car on the final afternoon to Riverdale, Md., to inspect the plant of the Engineering and Research Corp., as guests of Henry A. Berliner and Fred E. Weick. After seeing various aircraft production tools in operation, being shown the construction of wood and plastic propellers and a small two-place airplane with its engine, members and guests were taken to the airport at College Point, Md., to enjoy a demonstration flight of a small plane with tricycle landing gear.

Economics of Flush Riveting

Surprising test data that showed that such seemingly innocuous details as projecting rivets, lapped joints, and roughness on the outer surface of large airplanes may increase the horsepower required to propel them at high speeds by as much as 500 hp, compared with those with smooth skins, were revealed in the opening paper in the first Aircraft Session. The production technique of flush riveting—how costs were brought down to a figure very close to that of brazier-head riveting by automobile mass-production methods—was explained in the second paper. Starting the session promptly, Chairman R. C. Gazley, introduced the first speaker:

The Effects of Rivets and Surface Roughness on Drag—MANLEY HOOD, National Advisory Committee for Aeronautics.

EFFORTS to make all surfaces of airplanes exposed to air flow as smooth as possible will pay good dividends, Mr. Hood concludes. Even when all irregularities are eliminated from the forward 25% of the wing, he points out, considerable power is still required merely to pull the remaining rivet heads and lapped joints through the air. He shows that, for a large airplane, this extra power may amount to as much as 180 hp; that it necessitates about 270 lb of extra engine and propeller weight; that it means about 860 lb extra of fuel and tankage on a 10-hr flight; and that the total excess of 1130 lb can be translated into additional payload by eliminating the rest of the rivets and lapped joints and making the entire wing smooth and true.

The important results of recent wind-tunnel tests conducted by the NACA to determine the effects of common surface irregularities on wing drag, presented in his paper, Mr. Hood announces, show the increases in wing drag caused by representative arrangements of protruding and

countersunk rivet heads, lapped sheet-metal joints, and surface roughness. The effects of varying rivet size, spanwise rivet pitch, and the chord position of the forward row of rivets are given also. It is shown that manufacturing irregularities may be responsible for considerable excess drag over and above that due to the rivets and lapped joints.

A method is suggested of estimating the drag due to rivets and lapped joints under conditions of dynamic scale and of rivet and lap size and arrangement outside the range of the tests.

Questions relating to the basic aspects of the tests reported, to fabric-covered wings, to skin waviness and wrinkling were answered by Mr. Hood in discussion. Dr. Max M. Munk, Catholic University, asked whether tests had been made at different Reynolds Numbers and the same compressibility or, conversely, at the same Reynolds Number and different compressibilities. In reply, Mr. Hood explained that tests made for a 5-ft wing chord were duplicated for a 2-ft wing chord, and virtually the same increment of drag was obtained. The arrangement of rivets in the two wings was the same, he said. Compressibility effects within the range tested were not important, he reported.

To a question by Prof. Peter Altman, University of Detroit, Mr. Hood stated that he did not want to say what roughness would do at large Reynolds Numbers, but he believes that the increment due to roughness should increase indefinitely. We have just completed tests on the increment of drag due to skin waviness and wrinkles with butt joints and flush riveting, he told T. P. Wright, Curtiss-Wright Corp., and Rex B. Beisel, Chance-Vought Aircraft, but the answers are not yet ready. Asked about work on fabric-covered wings and the inevitable sag between ribs, by Prof. Altman and Chairman Gazley, he reported an appreciable difference between rough and smooth fabric. The effect of sag changes on the airfoil shape itself can, of course, be estimated, he said, explaining that he had no other data on the subject.

In Mr. Berlin's absence, Peter F. Rossman, of the same company, presented his paper:

Flush Riveting—Considerations for Quantity Production—DON R. BERLIN, Curtiss Aeroplane Division, Curtiss-Wright Corp.

AS a refinement that permits a smoother external or wetted surface of the airplane, and thus adds to aerodynamic cleanliness, flush riveting of the plane's skin is of utmost importance, Mr. Berlin points out. The ultimate object of the research reported, he explains, was to outline the problem of determining and providing requisite tools. No attempt is made in his paper to treat the aerodynamics and strength characteristics of flush riveting.

Among the phases of riveting that required careful analysis in the solution of the problem noted especially by Mr. Berlin are appearance, strength, processing methods, economics of production and sources for equipment and tools. Time studies were employed extensively, and close contact with the production departments was maintained in the work. A prodigious amount of attention to detail was required to coordinate the many activities in which the significance of some conditions could not be anticipated and additional investigation often was necessitated, the author reports.

There is no sanction for the contention that flush riveting in production quantities cannot be employed, except at an excessive and unavoidable cost penalty, he concludes.

T. P. Wright led off the discussion by paying a tribute to the flush-riveting technique described in Mr. Berlin's paper. He told how his company borrowed the mass-production riveting methods used from the automobile industry to bring the cost of flush riveting down below that of brazier riveting, 4 or 5 years ago. The more a job can be mechanized and human skill eliminated, he pointed out, the better the appearance and more reliable the job.

H. S. Dale, Glenn L. Martin Co., read a prepared discussion by B. C. Boulton of the same company, who told why he believes the 115-deg flush rivet head used by his company is superior to the 78-deg head used by Curtiss-Wright. The 115-deg rivet, Mr. Dale read, deforms the sheet much less when dimpled; requires less-specialized tools and less-skilled men; is less likely to crack; and has a larger grip on the sheet.

In addition, Mr. Dale explained how the problem of filling the space at the edge was solved by adding material to the top of the rivet.

In reply, Mr. Rossman conceded many of the points made in Mr. Boulton's discussion, such as the larger-angle rivets require less dimpling; however, he pointed out, it is easier to get the material up in the corner with a smaller angle in the rivet head. He also contended that the larger rivets, more largely used by Mr. Boulton's company, are better adapted to the use of larger-angle rivet heads.

How Limit Vibration?

Introduction of a new method for determining the allowable vibration amplitude of an aircraft engine stirred up a steady flow of discussion in the first Aircraft-Engine Session. The session's only speaker was introduced by Chairman L. B. Tuckerman.

Permissible Amplitudes of Torsional Vibration in Aircraft Engines—FRANCIS MASI, Naval Aircraft Factory.

ACTUAL computation of the vibratory crankshaft stresses, although a laborious process beset with many difficulties, should offer the best chance for an intelligent evaluation of the crankshaft torsional-vibration characteristics in aircraft engines and of whether the amplitudes are dangerous or within safe limits, Mr. Masi concludes. In a discussion of the various methods used, their relative merits, and allied problems, he shows that the simple expediency of using fixed allowable amplitude limits, for certain classes of engines, determined from experience, is likely to lead to erroneous conclusions.

A novel method, which has been used on numerous engines by the Naval Bureau of Aeronautics, is suggested by Mr. Masi. It consists in determining the twist of the crankshaft with the application of rated engine torque and basing the allowable vibration amplitude on the amount of the twist. This method, he reports, lends itself to rapid routine check of a variety of engines and gives reliable data for conventional designs.

In the light of present knowledge, he concludes, propeller vibration must be considered a separate and distinct problem peculiar to each engine-propeller combination, and requires separate and individual consideration.

Chairman Tuckerman opened debate on Mr. Masi's paper by reading written discussions by R. A. Cole, Wright Aeronautical Corp., and Ford L. Prescott, of the Materiel Division,

U. S. Army Air Corps, who were not present. Written discussions also were presented by W. G. Lundquist, Wright Aeronautical Corp., Harold Caminez, Aircraft Screw Products Co., A. T. Gregory, Ranger Engineering Corp., and E. S. Taylor, Massachusetts Institute of Technology.

Impromptu discussions were given by William L. Fisher, of the Naval Aircraft Factory, G. L. Williams, of Pratt and Whitney, and Mr. Wight, of the Civil Aeronautics Authority.

The discussers said the paper was a rational approach to the problem and very thorough. Some discussers thought that a rigid limit should not be placed on amplitude of vibration allowable because stress itself is what determines failure and not amplitude of vibration. Since vibration is influenced by propellers and engine as a system, close cooperation between propeller and engine manufacturers should exist. Fixed limits of vibration are a step in the right direction but, due to different types of construction, they sometimes are unfair on a particular design.

One discussor thought that static tests of a crankshaft are not sufficient for determining whether a crankshaft is satisfactory or not, because fillets, heat-treatments, cracks, and so on, can have more effect on them.

Another discussor cited the example of an engine being satisfactory on the factory test stand but, when a vibration damper was installed, the crankshaft proved unsatisfactory.

Some speakers wanted to place no limit on vibration, but merely say that the engine should be satisfactory in service.

Several discussers thought that measuring the vibration amplitude from the tail end of the crankshaft would be unsatisfactory in many cases. Different accessories would require a special treatment of each case, they believe.

One engineer asked if the effect of piston side thrust on vibration had been studied. This person stated that crankcases probably will be made of steel and vibration might be more severe. Dr. Tuckerman supplied information that aluminum has less internal damping than has steel, and the steel crankcases should not vibrate more than aluminum ones because of the material.

Another discussor then stated that making the crankcases of steel would introduce other construction problems.

Dinner Speaker and Toastmaster Talk with SAE President



G. Grant Mason, Jr., Civil Aeronautics Authority, principal speaker (left), SAE President W. J. Davidson (center) and Rear-Admiral E. S. Land, toastmaster

Another subject emphasized was the need of work on factors of safety.

The discussion also dealt with design and manufacturing procedure for the elimination of stress concentration and improper finishes on highly stressed steel.

Accessory Drives Argued

Which is the more reliable, electrical or mechanical accessory drives? If electrical, should the equipment be single phase or multiphase, AC or DC? How can the weight of electrical equipment be reduced? Should aircraft accessories be driven individually or from the main engine? These and other questions generated spirited discussion in the second Aircraft Session in which two papers were given. William Littlewood served as chairman and announced the first speaker:

The Application of Electrical Equipment to Aircraft - OSCAR F. OLSEN, Daniel Guggenheim School of Aeronautics, College of Engineering, New York University.

THE future use of electrical energy to perform the multiplying auxiliary functions in aircraft will far exceed the moderate applications of today, Mr. Olsen predicts. An unfounded skepticism as to the reliability of electrical energy; a lack of precedence; and the need for a light, high-speed, high-output generator are responsible for his belief that modern practice falls far below the extent to which electrical energy may be used economically, he states. Such a generator, he predicts, may be expected in the near future.

In his paper Mr. Olsen surveys the fundamental considerations involved in the application of electrical equipment to aircraft. Factors are reviewed that establish the rating of electrical equipment. Important limitations due to materials used in the construction of apparatus are noted, and how they may be influenced by some of the new developments. The adaptability of standard industrial equipment to aircraft requirements is evaluated, with the modifications desired. The range of electrical characteristics is reviewed, with the underlying characteristics that influence their selection. The more important equipment and some of the relatively new devices are explained and their application characteristics noted. The requirements for the coordination of equipment into a complete, reliable, flexible, and adequate system are set forth.

Chairman Littlewood started the discussion ball rolling by relating some of the troubles of his company with electrical equipment. Often when we put fuses in service with their axes in vertical, he reported, they melt and run down across the gaps so that we have 100-amp instead of 50-amp fuses. Our other difficulties have come mostly from moisture or oil vapor getting into the electrical equipment, he continued, voicing a plea for tighter seals.

Herbert M. Huckle, Civil Aeronautics Authority, contended that the question of a choice between 800-cycle single-phase and 400-cycle multiphase electrical power for accessories in airplanes is still an open one, explaining that he understood Mr. Olsen's paper to imply that the matter had been settled, with the lower-frequency multiphase power as the choice. As examples of large modern ships using single-phase high-frequency power, Mr. Huckle cited the DC-4 and the large Naval flying boat. We must remember, he reminded, that there are many ways of transmitting power to accessories, and the method selected depends upon the conditions in each case. For example, it depends upon how far an aileron is from its source of power whether it should be operated hydraulically or electrically. If far away, electrically; if close, hydraulically. This was a decisive reason in the choice of hydraulic power for lifting the wheels of the DC-4, he reported, plus the fact that hydraulic drive seems to have more overload capacity.

With the large and increasing number of accessories and gadgets that are being put in many large planes today, failures are bound to occur for this reason alone, pointed out M. G. Beard, American Airlines, Inc. On the reliability controversy, he expressed his opinion that mechanical drives had the edge because of the tendency of contacts and switches to fail. He recalled several times in his experience when me-

chanical drive had been chosen over electrical because of the high weight ratio of the electrical drives. He closed by stressing the need for a landing light to go flush in the wings - one that will not ice and increase drag.

Among the electrical systems, the DC system is the most reliable, opined C. C. Shangran, Bendix Aviation Corp., because peak power can be drawn momentarily from the battery.

Edward Minor, Glenn L. Martin Co., added his voice to those who contend that much electrical equipment is unnecessarily heavy. The reason for this condition, he believes, is that much electrical equipment for aircraft is still being built to old commercial designs and standards, especially switches and control equipment, probably because the aircraft market is still too small and specialized to make their redesign an economic project.

After first agreeing with Mr. Huckle that the choice between phases and frequencies is still an open question, Mr. Olsen explained that, in his emphasis on the reliability of electrical equipment, he was referring to the reliability that should be obtained in the future.

In the author's absence, the second paper of the session was read by Mr. Shangran:

Present-Day Problems in Accessory Drive - R. P. LANSING, New Jersey Division, Bendix Aviation Corp.

PERTINENT questions are asked in his paper, Mr. Lansing explains, in the hope that they may lead to a crystallization of problems that will determine the line of activity which the accessory manufacturer should follow to provide adequate drives for accessory equipment.

The paper brings out the numerous problems found in the design of accessory power supplies for the larger airplanes and the involvements incident to such design, without attempting to forecast their solutions. These problems, Mr. Lansing points out, are primarily the result of the requirements of the long-range plane. It is shown that, in these planes, controls other than flight controls require substantial power to operate them. Landing gears which must be operated are of substantial weight and size, and require considerable power to retract and extend. Flaps and tabs require power, although in smaller amounts. Radio has many ramifications, such as communications, beam flying, orientation, blind flying, and emergency equipment, all of which necessitate a large increase in power. Pressure cabins also add to the demands for auxiliary power.

Topics discussed are choice of generator drive; accessory drives from main engines; drive by accessory engines; and actuation by electric motor, hydraulics, air pressure, and vacuum.

Discussion of Mr. Lansing's paper took the form of an informal round-table debate in which Messrs. Minor and Shangran, Chairman Littlewood, Frank M. Bondon, Civil Aeronautics Authority, Capt. R. W. A. Brewer, and J. P. Benjamin, Glenn L. Martin Co., participated.

From the standpoint of overall efficiency, electrical drives are superior to hydraulic, pointed out Mr. Minor, citing examples of hydraulic drive where the overall efficiency was less than 20%.

What does the aircraft industry want in accessory drives that can be standardized? asked Capt. Brewer. What is it willing to sacrifice to get 100% reliability?

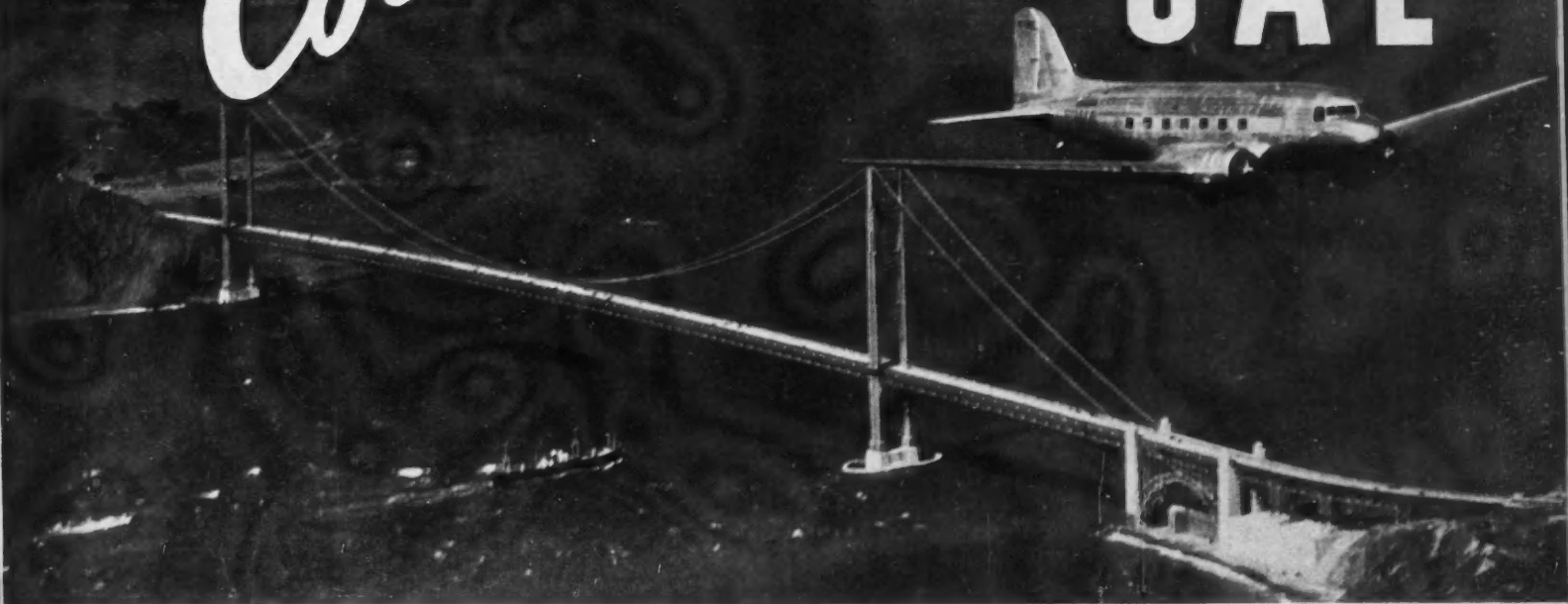
In answer Mr. Minor reviewed the accessory drive situation from the standpoint of the aircraft manufacturer, explaining how rapid obsolescence works against standardization, and how cost and weight must be balanced against reliability.

Mr. Bondon brought the exhaust turbo method of drive into the discussion. The problems to be solved, he reported, are those of gas pulsations and weight, especially if power must be transmitted a distance from the engine.

The harmful effect of radial air-cooled engine vibration on electrical equipment and accessory drives is one more reason for the belief that liquid-cooled engines that can be faired into the wings and that have better vibration characteristics, will soon replace them, contended Mr. Benjamin.

(Continued on page 20)

Coast-to-Coast with SAE



The Golden Gate (above) will form the background for the final meeting of the 1939 World Automotive Engineering Congress of the SAE, which opens May 22 in New York. Many will make the transcontinental trip by air.

THE 1939 WORLD AUTOMOTIVE ENGINEERING CONGRESS of the Society of Automotive Engineers offers the most elaborate program in the Society's history.

The backdrop of the Congress is the whole United States, and everyone who participates in the program can visit both the New York World's Fair and the Golden Gate International Exposition, and see the scenic wonders of the Western, Mountain, and Pacific Coast States. Details of the sightseeing trips, transportation and hotel reservations, and general tour arrangements have been worked out by travel experts of the American Express Co., under the supervision of the Society's Meetings Committee.¹

Round trip fares from any city in the United States, providing all accommodations for Congress meetings and many special events, visiting both the fairs, and including the sightseeing trips, are available for \$306.10, minimum. (See table of basic prices, p. 16). Arrangements for variations of the tour can be made at any local office of the American Express Co.

Congress Opens May 22

The opening session of the Congress takes place Monday, May 22, in the Hotel Pennsylvania, New York. During the week there will be ample opportunity to visit the New York World's Fair, inspect some of the world famous traffic engi-

¹ "Tentative Technical Program of 1939 World Automotive Engineering Congress," pp. 12-16, SAE JOURNAL, March, 1939.

neering achievements throughout the Metropolitan area, and to make other interesting sightseeing trips.

Wednesday, May 24, has been designated as "World Automotive Engineering Day" at the World's Fair.

Throughout the whole Congress special entertainment will be arranged for wives and other guests while members and delegates are attending the technical sessions. A representative of the tour agency will be at the registration desk of the Congress in the hotel to make arrangements for any sightseeing trip desired, and members of local entertainment committees of the Metropolitan Section, SAE, will be on hand to assist out-of-town guests in making plans for their entertainment while in New York.

The International Banquet, Friday, May 26, in the Hotel Pennsylvania, will close the five-day technical meeting in New York. Saturday and Sunday will be spent in New York, the Congress leaving Sunday evening for Indianapolis on air-conditioned trains. These trains will serve as Congress headquarters during the second stage of the schedule.

Arriving in Indianapolis on Monday morning, May 29, the trains will be shunted on tracks near the entrance of the Speedway. After breakfast on the train, members will visit the race track, inspect the pits, and meet some of the drivers.

NEW YORK
May 22-28

INDIANAPOLIS
May 29-30

DETROIT
May 31-June 2

SAN FRANCISCO
June 6-8

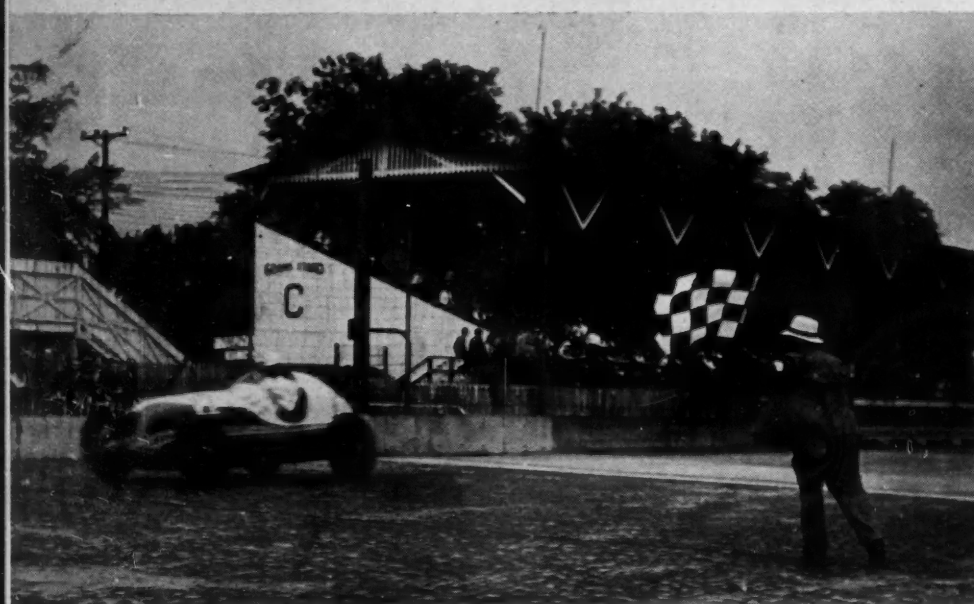


Views Along

New York (left) will be the scene of the opening of the Congress on May 22. Ample opportunities for sightseeing are offered.

The 500-Mile International Sweepstakes at Indianapolis (center) will be the main feature of the second stage of the Congress.

America's scenic wonders will be a long-remembered feature of the Congress. The Grand Canyon is seen below.



Women members of the party will be taken to Indianapolis, where an interesting program is being arranged for their entertainment. Returning to the train before 5:30, the Congress will be taken to the Indianapolis station in the train, and will be driven to the Columbia Club in that city for the Pre-Race Dinner, being held under the auspices of the SAE Indiana Section. Following the dinner, the train will take the Congress back to the Speedway.

A special section in the grandstands has been reserved for the Congress, and box lunches will be prepared so that no one need miss any part of the sweepstakes event.

Immediately following the race, the Congress will again board its special train and have dinner while en route to Detroit. Everyone who has attended previous races at the Speedway will realize the great convenience of having the air-conditioned train for the Congress headquarters, thus avoiding the heavy highway traffic to and from the race track.

Headquarters of the Congress will be in Hotel Statler, Detroit, for the three days in the automotive capital of the world. While delegates are making the tours of inspection at the Ford, Chrysler and General Motors factories and proving grounds, entertainment will be provided for women guests of members. The Detroit portion of the Congress will last from Wednesday, May 31, to June 2, and close with a banquet in the Hotel Statler.



the Route

The 3600 hp diesel-powered "Super Chief," the luxuriously appointed Santa Fe streamliner which will carry Congress delegates from Chicago to the Pacific Coast.

The Congress leaves Detroit for Chicago the evening of June 2, where it will spend the day of June 3 in sightseeing in motorcoaches provided by the Congress. In the evening, the Congress will board the "Super Chief" of the Santa Fe railroad, and head westward through the scenic wonders of the Western States. The "Super Chief" is driven by a 3600-hp diesel powerplant, and is a nine-car train built by two leading car shops. Beautifully appointed, it will be a long-remembered feature of the Congress.

A day's stop for sightseeing in Los Angeles will break the transcontinental trip, and the Congress will proceed to San Francisco for the final portion of the technical program.

Congress headquarters in San Francisco will be the Hotel Fairmont. Special plans are being made to entertain guests of those attending the three-day technical meeting, and ample opportunity will be given for visiting Treasure Island, the home of the Golden Gate International Exposition, and making other sightseeing trips in that part of the country.

Members planning to make the Congress a combined technical meeting and vacation, will find it possible to work out many interesting modifications of the schedule outlined above, particularly in making the return trip.

Pierces' Ferry, typical of some of the scenes through which the Congress will travel between Detroit and the West Coast. (Center).

Arrangements have been made for the Congress to visit the Golden Gate International Exposition at San Francisco (right).





Whole World is Hearing of SAE Congress

NEWSPAPERS, technical journals, and trade magazines throughout the world have been publicizing the 1939 World Automotive Engineering Congress of the Society of Automotive Engineers for the past six months. Total circulations of the many releases supplied by the SAE run into the millions.

A series of well-timed news releases have been sent to more than 150 American, Canadian, and overseas newspapers. Announcements of the Congress, its program, and speakers have

been published in Norway, Sweden, Denmark, The Netherlands, France, Belgium, Canada, Great Britain, Czechoslovakia, Italy, China, Japan, several British possessions, and Central and South American countries.

Thirty-five foreign governments have been invited to send official delegates to participate in the Congress, and more than 30 technical societies abroad and a score of leading technical organizations interested in some phase of automotive engineering, have been invited to participate in the meetings.

Cost of Congress Tour From Any City in the U. S. and Return

(Estimate made by the American Express Co. Please make arrangements for your traveling through your local American Express Co. office. The prices below are based on using railroads for transportation. Arrangements can also be made for air travel.)

Cost per Person

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Hotel accommodations, basis twin-bedded rooms with bath, at all stop-over points including New York and San Francisco during the Congress. At Indianapolis, accommodations are provided in air-conditioned cars.

All meals (table d'hôte plan with variety of choice) beginning with dinners on May 28 upon departure from New York up to and including breakfast on June 9 at San Francisco, excepting luncheons at San Francisco and

the International Dinners to be held May 28, May 29, June 1 and June 8. Arrangements for participation in the International Dinners must be made with the SAE.

Sightseeing and visits to organizations as indicated in the itinerary are included.

The cost of tickets covering admission and seats at the Indianapolis race is not a part of the tour price and should therefore be ordered separately, but must be included at the time you make your payment for the tour. The prices are:

Grand Stand	\$6.25
Box Seats	9.75
Choice Box Seats	12.75

* Members booked in Roomette will be provided with exclusive occupancy of section from New York to Chicago.

SAE Constitution Amended to Grant Service Members More Privileges

AS the result of a 939 to 96 vote, the Constitution of the Society has been amended to grant Service Members the right to vote and the privilege to hold office. The sections of the Constitution which have been amended follow in their revised form:

C-5 The membership of the Society shall consist of Honorary Members, Members, Associates, Juniors, Departmental Members, Service Members, Foreign Members and Affiliate Members. Honorary Members, Members and Service Members are entitled to vote and to hold office. Associates, Juniors, Departmental Members, Foreign Members and Affiliate Members shall not be entitled to vote or to be officers of the Society but shall be entitled to the other privileges.

C-6 Honorary Members, Members and Service Members are entitled to vote on all questions at any meeting of the Society, in person, or by proxy given to a voting member. A proxy shall not be valid for a greater time than six months.

C-14 Honorary Members shall be nominated by at least ten voting members of the Society. The grounds upon which the nomination is made shall be presented to the Council in writing.

C-24 The Council shall have the power, by letter ballot, to admit to Life Membership, without the payment of a life membership fee, any person who, for a long term of years, has been a Member, Service Member or an Associate, when, for special reasons, such procedure would, in its judgment, promote the best interests of the Society, provided that notice of such proposed action shall have been given at a previous meeting of the Council. One dissenting vote shall defeat such admission.

C-29 The affairs of the Society shall be managed by a board of directors chosen from among its voting members, which shall be styled the "Council." The Council shall consist of the President; the Vice-Presidents representing, one each respectively, the Professional Activities of the Society recognized by the Council on a National basis and specified in the By-Laws; six Councilors; the Treasurer; and the two surviving Past-Presidents who last held office. One-third of the number of voting members of the Council shall constitute a quorum for the transaction of business. The Secretary may take part in the deliberations of the Council, but shall not have a vote therein. The Chairmen of the Administrative and of the Technical Committees may attend the meetings of the Council and take part in the discussion of questions affecting their Committees, but shall not have a vote.

C-30 Should a vacancy occur in the Council or in any elective office except the Presidency, through death, resignation or other cause, the Council may select a voting member of the Society to fill the vacancy until the next annual election. Should a vacancy occur in the Presidency, the Council shall select one of its number to fill the vacancy until the next annual election.

C-34 The Council may, by a two-thirds vote of the members present, declare any elective office vacant, on the failure of its incumbent for six months, from inability or otherwise, to attend the Council meetings, or to perform the duties of his office, and shall thereupon appoint a voting member to fill the vacancy until the next Annual Meeting. The said appointment shall not render the appointee ineligible to election to any office.

C-35 Each year there shall be elected from among the voting members:

A President, to hold office for one year.

As many Vice-Presidents, each to hold office for one year, as there are recognized Professional Activities of the Society, specified in the By-Laws.

Three Councilors, each to hold office for two years.

A Treasurer, to hold office for one year.

C-39 The Council at its first meeting after the Annual Meeting of the Society, shall appoint a voting member to serve as Secretary of the Society for one year, subject to removal for cause by an affirmative vote of the members of the Council, at any time after one month's written notice has been given him to show cause why he should not be removed, and he has been heard in his own defense, if he so desires. The Secretary shall receive a salary which shall be fixed by the Council at the time of his appointment.

C-41 The Society shall hold two meetings in each year. The Annual Meeting and a Semi-Annual Meeting shall be held at such time and place as the Council may appoint. Fifty voting members shall constitute a quorum for the transaction of business.

C-46 The Annual Nominating Committee of the Society shall consist of three delegates at large, and one delegate from each geographical Section of the Society. No two of the delegates at large shall reside in the same Section district. The delegates at large shall be elected by the voting members present at the Business Session of the Annual Meeting. The Section delegates shall each be voting members elected by and from each Section prior to the Annual Meeting of the Society. Each Section may elect in addition to a delegate, a first alternate and a second alternate. The first alternate shall serve in the absence of the delegate, and the second alternate shall serve in the absence of both the delegate and the first alternate. Neither a delegate nor an alternate may be represented by a proxy at a meeting of the Nominating Committee. The work and procedure of the Committee shall be as defined in the By-laws.

John A. C. Warner, Secretary

Changes in the By-Laws, to bring them into accord with the Constitution as amended, were voted by the Council of the Society at its meeting in Detroit, Jan. 13. The amended By-Laws read as follows:

B-26 (*Second Paragraph*) In the inaugural year of any Professional Activity its Vice-President shall be nominated by a Nominating Committee consisting of seven voting members, elected at a meeting of the Committee representing the Professional Activity concerned, held prior to Oct. 1. Not more than two of the seven members elected shall be chosen from any one Section of the Society. A majority of the members of the Nominating Committee so elected shall concur in the final recommendations of the Committee. It shall be the duty of such Committee to send to the Secretary on or before Oct. 1, of such inaugural year, the name of one consenting nominee for the Vice-Presidency representing the Activity.

B-26 (*Third Paragraph*) During each subsequent year of a Professional Activity its Vice-President shall be nominated by a Nominating Committee consisting of seven voting members, two to be elected by the Professional Activity Committee and the remaining five elected at a stated Business Session of the Professional Activity which he is to represent,

held prior to August 1. Not more than two of the seven members elected shall be chosen from any one Section of the Society. A majority of the members of the Nominating Committee so elected shall concur in the final recommendations of the Committee. It shall be the duty of such Committee to send to the Secretary on or before September 1 the name of one consenting nominee for the Vice-Presidency representing the Activity.

B-35 - Each proxy authorizing a voting member to vote for an absent voting member, shall be signed by such absent member, with an attesting witness, and be submitted to the Secretary for verification of the member's right to vote at the meeting at which the right is to be exercised.

An elected officer or a member elected to fulfil a certain definite duty cannot delegate this authority.

John A. C. Warner, Secretary

About SAE Members:

FRANK M. SMITH, vice-president and general manager, Stout Engineering Laboratories, Inc., has been elected to the board of directors of the Hupp Motor Car Corp.

G. C. STEVENS, district manager for the Diamond T Motor Car Co. at St. Louis, has been transferred to Chicago as manager of its Chicago branch. He has been affiliated with the Diamond T organization since 1921. Mr. Stevens is a past-chairman of the SAE St. Louis Section.

C. M. EASON, a past-chairman of the Milwaukee Section, has been elected president of



C. M. Eason

the Industrial Clutch Co., Waukesha, Wis. He previously was general manager of the company.

The appointment of **DR. JEROME C. HUNSAKER**, aeronautical engineer and head of the department of mechanical engineering at Massachusetts Institute of Technology, as consultant to American Export Airlines, which will begin experimental trans-Atlantic flights this month, recently was announced by W. H. Cloverdale, president of the airline. "Dr. Hunsaker will act in a consulting capacity, while continuing his work at M.I.T., on problems in connection with our flying operations, equipment, and weather forecasting," Mr. Cloverdale explained.

EUGENE HERVEY recently joined Arthur G. McKee & Co., Cleveland, as mechanical engineer. He formerly held the same title with the Detroit Edison Co.

HOWARD A. FLOGAUS, who was chief engineer of the Reo Motor Car Co., Lansing, Mich., has joined the J. G. Brill Co., Philadelphia, as assistant to vice-president.

FRANK OBERLE, formerly a member of the diesel sales division of Hercules Motors Corp., Canton, Ohio, has joined the sales division of the American Bosch Corp., Springfield, Mass. Mr. Oberle was previously connected with the Bosch organization for many years as a fuel injection equipment sales engineer.

CHARLES E. DIXON, formerly a student at Purdue University, has joined the Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn., as test engineer.

J. F. CREAMER, president of Wheels, Inc., New York, recently was reelected vice-president of the National Wheel & Rim Association.

M. W. McCONKEY is the newly elected president of the Hydraulic Brake Co. of Detroit, a subsidiary of Bendix Aviation Corp. He has been associated with the Bendix interests as patent counsel since 1925, and retains this connection. Mr. McConkey is a member of the SAE Patents Committee.

DON O. SCOTT, who has been president of the Hydraulic Brake Co. since its inception, resigned that office in order to take over the full-time management of Bendix Home Appliances, Inc., of South Bend, a separate organization whose product, the Bendix Home Laundry, was developed under his supervision.

L. G. KNAPP has joined the Master Electric Co., Dayton, Ohio, as manager of the industrial equipment division.

PAUL V. FARAGHER, metallurgist, metallurgical division, Aluminum Co. of America, and chairman of the non-ferrous metals division of the SAE Standards Committee, spoke before the March 16 science forum of the New York Electrical Society on "Aluminum in Industry."

FRED S. KRAMER, formerly lecturer on aeronautics at the South African Air Force, Robert's Heights, under auspices of the Pretoria Technical College, South Africa, is visiting the United States. Upon his return to South Africa he will represent various American aeronautical concerns at Johannesburg. Prior to his sailing on April 7, Mr. Kramer may be reached through SAE Headquarters.

MICHAEL J. ROSS, formerly with the Wagner Electric Corp., St. Louis, Mo., has joined the Electro-Motive Corp., at La Grange, Ill., as plant engineer.

JAMES M. SMITH has joined the general engineering staff of the Mack Manufacturing Corp., Allentown, Pa.

EARL E. WRIGHT's appointment as Denver branch manager for the Fruehauf Trailer Co. recently was announced. Mr. Wright joined the Fruehauf company after 20 years' experience in transportation work with the International Harvester Co.

CHARLES E. SPEAKS, president, Fisk Rubber Corp., and **F. E. SCHLUTER**, president, Thermoid Co., have been named vice-chairmen of the National Association of Manufacturers' committees on employment relations and government finance, respectively.

On Feb. 23 the City of Akron celebrated the 100th anniversary of the discovery by Charles Goodyear of the process of vulcanizing rubber. Thousands assembled in the afternoon for the unveiling of a statue of Charles Goodyear which was presented to the city by **P. W. LITCHFIELD**, president of the Goodyear Tire & Rubber Co.

WILLIAM H. WELCH, formerly with the Bowes "Seal Fast" Corp., Indianapolis, has joined the sales staff of the H. A. Waterman Co., of the same city.

Since Feb. 1, **L. R. RUOFF** has been with the Aircraft Screw Products Co., Elmhurst, N. Y., as toolmaker. Before that he was a salesman with Interborough Truck Equipment Co., Inc., Long Island City.

HARRY E. SCHWEIGLER has joined the engineering department of the Glenn L. Martin Co., Baltimore.

DWIGHT M. GORDON, engineer with the Carter Carburetor Corp., has been transferred from St. Louis to Toledo. Because of this change Mr. Gordon has resigned as Secretary of the St. Louis Section. **ARCHIE R. BURGESS**, instructor in mechanical engineering at Washington University, will fill this office for the remainder of the Section year. Mr. Burgess also heads the Section's membership committee and is field editor for the SAE Journal.

SAE members participating in the program of the Midwest Power Conference, to be sponsored by the Armour Institute of Technology, April 5-7, Chicago, include **DANIEL ROESCH**, of the Institute, chairman of the diesel power session; **L. H. MORRISON**, editor, *Diesel Power*, and **C. G. A. ROSEN**, assistant chief engineer in charge of diesel research, Caterpillar Tractor Co., speakers at that session. **O. A. LEUTWILER** will represent the University of Illinois at the Conference.

SIDNEY CORNELL has rejoined the Fellows Gear Shaper Co., Springfield, Vt., as draftsman. For some time he was with the Lockheed Aircraft Corp., Burbank, Calif., as senior detailer.

WALLACE LINVILLE, automotive engineer with the General Petroleum Co., has been transferred from Los Angeles to San Francisco.

VIGGO M. BLEGVAD recently joined the Packard Motor Car Co., Detroit, as engineering draftsman. He was formerly at the General Motors Proving Ground, Milford, Mich.

DAVID BEECROFT, treasurer of the SAE, represented the Society on the general committee of the tenth annual convention of the Greater New York Safety Council, held late last month. Many SAE members were on the program.

F. K. GLYNN, American Telephone & Telegraph Co., who represents the Society on the American Standards Association Mechanical Standards Committee, has been elected a member of that group's executive committee.

Johansson Honored



TORE FRANZEN, president of the Detroit Swedish Engineers Society and experimental engineer with the Chrysler Corp., presided at a testimonial dinner, Feb. 28, honoring **C. E. Johansson**, who developed the first set of metric gage blocks in 1896. Mr. Franzen is shown presenting a plaque to Mr. Johansson's daughter, Mrs. Gertrud Tufford, who in turn presented it to her father at the celebration of his 75th birthday, at Eskilstuna, Sweden, March 15.

JOHN A. SPANOGLE has been mechanical engineer with the United States Army Air Corps at Wright Field, Dayton, Ohio, since February.

JAMES WOOD, who received his B.S. in chemical engineering from the University of Oklahoma in January, is chemist with the Borger, Texas, refinery of the Phillips Petroleum Co.

CAPT. E. V. RICKENBACKER, president of Eastern Air Lines, has been made chairman of the advisory sports committee of the New York World's Fair, succeeding the late Col. Jacob Ruppert.

K. T. KELLER, president, Chrysler Corp., is Michigan general chairman of a committee to make arrangements for Army Day, April 6.

Speaking on plastics, **H. M. RICHARDSON**, engineer, plastics department, General Electric Co., addressed a recent meeting of the Indiana Engineering Council.

A. K. BRUMBAUGH, who, for the past three years has been West Coast representative for the Timken-Detroit Axle Co., with headquarters in San Francisco, has joined the engineering staff of Knuckey Truck Co., Inc., of the same city. The company manufac-



A. K. Brumbaugh

tures trucks and was organized in February of this year. Mr. Brumbaugh has been connected with the truck industry for a number of years and has been SAE vice-president representing the Truck, Bus & Railcar Activity. He has also been a member of the SAE Council, Production Activity vice-president, chairman of the Cleveland and Philadelphia Sections, and active on other SAE committees.

IGOR I. SIKORSKY, **L. K. SILLCOX**, **OLIVER F. ALLEN**, and **MERRILL C. HORINE** are among those presenting technical papers at the "Spring Round-Up" meeting of the American Society of Mechanical Engineers, Hotel Astor, New York, April 20.

EUGENE E. WILSON, United Aircraft Corp., recently was elected a vice-president and director of the Manufacturers Aircraft Association, which administers the cross-licensing patent agreement for the airplane manufacturing industry in the United States. Others elected to the board of directors include: **W. H. BEAL**, Aviation Manufacturing Corp.; **CLAYTON J. BRUKNER**, Waco Aircraft Co.; and **L. R. GRUMMAN**, Aircraft Engineering Corp.

VERNE E. HOLMES, formerly a member of the SAE Student Branch at Purdue University, is with the Fisher Body Division, General Motors Corp., Grand Rapids Stamping Division.

Johnston Retires; Scarratt Succeeds

E. A. Johnston



EDWARD A. JOHNSTON, vice-president in charge of engineering and patents, International Harvester Co., has retired after 50 years in the industry, 45 years of which were spent with the Harvester company or its predecessors. In 1938 Mr. Johnston, in honor of his outstanding accomplishments as an agricultural engineer, was awarded the Cyrus Hall McCormick Medal of the American Society of Agricultural Engineers. Between 1897 and 1938 Mr. Johnston was granted a total of 171 patents on farm implements and the allied lines of tractors and motor trucks. Active in SAE work, Mr. Johnston was a Councilor in 1919 and 1920, and chairman of the Standards Committee from 1921 to 1925.

A. W. SCARRATT, who has been Mr. Johnston's assistant since 1936, succeeds him as vice-president in charge of engineering and patents. Mr. Scarratt joined the Harvester company in 1927 as chief engineer of motor trucks and coaches. In 1935 he was promoted to chief of automotive engineering, and the following year he became assistant to Mr. Johnston.



A. W. Scarratt

About Authors

(Concluded from page 7)

ceiving his M.E. degree from Columbia University in 1913. He soon came in contact with the aviation industry as associate editor of an aviation magazine; this experience gave him the background for his first paper before the Society on airplane engines in 1915. Shortly afterward he joined the Westinghouse Machine Works to aid in the design of a special airplane engine but spent much of his time in steam turbine design. During the War he served in France with the U. S. Naval Air Forces and immediately after release from service joined The Texas Co. as automotive engineer. During the past 20 years with this company he has carried out research investigations on the performance and applications of motor fuels and lubricants, some of which have been presented in papers before the SAE. He also has aided in the layout and operation of three mechanical research laboratories, and now has the title of research engineer.

• **C. B. Veal**, once associated in consulting practice with the late C. M. Manly, became SAE research manager in 1927. During and after the War he was with Curtiss Aeroplane & Motor Co. in a consulting capacity. Graduated from Purdue, he taught there for some years.

• **Carl J. Wenzinger** has been devoting most of his time to aerodynamic research on problems of high-lift devices for airplanes, lateral-control devices, lateral stability, and air loads on wings with high-lift devices, at the Langley Memorial Aeronautical Laboratories of the National Advisory Committee for Aeronautics, with which he has been affiliated since 1927. He is in charge of the NACA's 7 x 10-ft wind tunnel and 4 x 6-ft vertical wind tunnel.

Before joining the NACA, Mr. Wenzinger had been affiliated with the Brown Electrical Instrument Co. and the Bell Telephone Co. of Pennsylvania. Swarthmore College granted him the degrees of A.B. in electrical engineering and M.E.

William F. Parish

William Francis Parish, consulting lubrication engineer and a member of the Society since 1912, died March 7. He was 65 years old.

Long affiliated with the petroleum industry, Mr. Parish was affiliated successively with the Standard Oil Co. of Indiana; the Vacuum Oil Co., both here and abroad; the Texas Co.; and the Sinclair Consolidated Oil Co. Since 1922 he practiced as a consulting lubrication engineer with offices in New York.

Mr. Parish served in the United States Navy during the Spanish-American War, and during the World War entered the Signal Corps and was later transferred to the Air Corps.

E. F. Hallock

Edward F. Hallock, an authority of automotive lubrication, died Feb. 23, at the age of 50. For the past five years Mr. Hallock was chief automotive engineer in the United States for Socony-Vacuum Oil Co., Inc. He had joined the Vacuum Oil Co. in 1918 and continued with the organization after its merger with Socony.

After studying engineering at Cooper Union in New York, Mr. Hallock operated a marine repair shop in Brooklyn. He later served in editorial capacities on several technical publications, including: *Motor World* and *Motorcycle Review*, in New York; *Motorcycling* in Chicago; and *Automobile Digest* in Cincinnati, before returning to New York to join the oil company.

Mr. Hallock became a member of the SAE in 1924.

SAE National Aeronautic Meeting

(Continued from page 12)

To close the session Mr. Shangran told of how increasing engine vibration had caused breakage in magnesium castings located in limited space, and had necessitated changing the material to aluminum and then to steel to insure against such breakage.

Fuel Economy Stressed

Fresh data on how to improve fuel economy in gasoline aircraft engines and an explanation of how the torque meter can be used to give laboratory-precision power control in airline operation, were offered in the 2 papers at the second Aircraft-Engine Session. Chairman H. K. Cummings directed the wide discussion that followed each paper.

Fuel Economy Possibilities of the Otto-Cycle Aircraft Engine - D. S. HERSEY, Pratt & Whitney Aircraft, Division of United Aircraft Corp.

MR. HERSEY shows that excellent economy can be obtained from the Otto-cycle aircraft engine by operation at high compression ratios, high mechanical efficiency values, and optimum spark advance. The limiting factor affecting such desirable operation is found to be detonation which can be suppressed by several means that are generally different for the cruising and high-output power conditions.

Economy of present-day aircraft engines can be improved merely by resorting to spark-advance control, the author asserts. The reduction of cruising intake-charge temperatures by the employment of multispeed superchargers with adequate charge intercooling, also should permit the early use of slightly higher compression ratios, he states.

Finally, Mr. Hersey suggests that an engine developed primarily for economy should be able to develop its maximum cruising output at sea level when unboosted and operated at moderate speeds, thus permitting higher compression ratios with further improvement in economy.

The paper outlines the general and economy requirements of existing aircraft engines, and the economy effects of various operating conditions. The factors that affect detonation at both high output and economy conditions, as well as the compromises necessary to avoid detonation, are considered in some detail.

The first discussor of Mr. Hersey's paper mentioned the fact that the effect of distribution in multicylinder engines often has a great effect on economy.

Another discussor asked if attention was given to humidity. In answer, it was stated that consideration was given to humidity, and tests often were run with water injection for suppressed detonation.

The next speaker remarked about water injection, stating that, in his experience, water injection within a few hours had caused spark-plug electrodes to corrode so that the gap increased to 0.150 in.

A fourth discussor stated that insufficient attention has been given to the valve timing suitable for best economy. A long and very interesting discussion took place between several of the people attending.

When it was asked if one fuel can be suitable for best economy during cruising and for take-off, the answer was that the fuel best suited for cruising conditions can be used for take-off by enriching the mixture or retarding the spark.

Another point brought out in the discussion was that an increase of power can be obtained for take-off by merely increasing engine speed and not necessarily making detonation conditions worse.

Considerable discussion arose concerning the relative merits of exhaust turbo superchargers and gear-driven superchargers. Although exhaust-driven superchargers obtained work from the exhaust gases, they caused additional power pressure which, for most conditions, makes the exhaust-driven supercharger less efficient than the gear-driven one, it was brought out.

Another discussor added that the opposite condition is true at very high altitudes.

Airline Power Control with a Torque Meter - W. G. LUNDQUIST, Wright Aeronautical Corp.

HOW the airlines can obtain laboratory-precision power control by means of a torque meter, is explained by Mr. Lundquist. He tells how the device provides an accurate method for controlling both brake horsepower and fuel-air ratio. The simplicity of the method is stressed, and its limitations under various operating conditions are brought out.

In this paper the author presents an impartial discussion of the principal phases of the general problem to assist airline operators in evaluating the possible benefits that they individually might achieve by the use of torque meters. He points out that the long-range operator is the only one who probably will realize any appreciable improvement in operating efficiency by the use of the torque meter, and even he must survey carefully his present operations to ascertain whether or not he already is operating so near to maximum efficiency that the application of the torque meter will not produce any benefits. The torque meter will add from 10 to 50 lb to an engine, including the indicating equipment, the author reveals.

The mechanical features of some current torque-meter types are reviewed.

The question immediately was raised: "Would each torque meter have to be calibrated on each engine used?" Mr. Lundquist answered that the meters do not vary outside their inherent accuracy when placed on different engines and do not have to be calibrated for each installation.

Considerable discussion took place about the effect of torque meters on torsional vibration, but few data were available. One discussor thought the effect of torque meters on torsional vibration could not be predicted certainly. Mr. Lundquist explained why there should be no difficulty.

One person explained conditions in present transport planes, stating that pilots now have as many meters to read and adjust as they have time for in bad weather but that, in good weather, they would have more time. What is really needed badly is a simple instant-reading meter that will eliminate several other meters, it was brought out. A horsepower meter would be much more useful than a torque meter.

The 50 lb per engine added of torque meter would probably be prohibitive, but 10 lb would be very satisfactory, in the opinion of some.

The cost of torque meters has not been determined, and no difference in the frequency of torsional vibration has been detected by the introduction of torque meters, the author concluded.

Propeller Icing Studied

The showing of the first pictures of ice formation on feathered propellers in flight ever taken, called "aeronautical history" by Chairman F. W. Caldwell, featured the presentation of the first paper at the combined Aircraft and Aircraft-Engine Session. In it feathering propellers were explained from all angles. Pictures also were the highlight of the second paper in which CAA research aimed at reducing aircraft fire hazards was reported - colored moving pictures of actual fuel-dumping tests. The authors of the first paper divided its reading about evenly between them:

Feathering Propellers in Airline Operation - M. G. BEARD and E. W. FULLER, American Airlines, Inc.

THE feathering propeller meets two fundamental needs in airline operation which the constant-speed propeller cannot meet, the authors explain. First, by stopping the rotation of an engine and propeller in flight, it protects the airplane from catastrophic vibrations occasionally set up by mechanical failures of engine and propeller. And the second fundamental need, they state, is that the feathering propeller decreases the drag of an inoperative propeller, thereby increasing the performance of a multiengine airplane with one or more engines inoperative. For these reasons, they point out, the feathering propeller has been accepted by leading airlines as the answer to their immediate propeller needs.

In this paper the full-feathering principle is explained as applied in two distinct propeller designs.

Performance figures are given for twin-engined air-transport planes with and without feathering propellers, and the importance of the feathering propeller in the operation of four-engined airplanes and its beneficial effect upon their twin and triple-engine performance are pointed out. Propeller icing, pertinent flight test data, the value of the feathering propeller in studying propeller ice in flight, and future propeller design trends, also are discussed by the authors.

Noting that the authors report that vibration helps to de-ice propellers, R. S. White, Civil Aeronautics Authority, suggested that forced vibration might be employed to remove propeller ice. "The only trouble with this method is that it might remove the blades too," he warned.

A Report of Studies and Tests to Decrease Aircraft Fire Hazards - ALLAN W. DALLAS, Civil Aeronautics Authority.

FUEL may be dumped safely from an airplane in flight, provided that it is discharged clear of the airplane structure, Mr. Dallas concludes, revealing the results of tests that included the actual ignition of gasoline and fuel oils in an air stream. In his paper he reports the activities of the Technical Development Division of the Civil Aeronautics Authority in connection with aircraft fire hazards.

A comprehensive test program is now being formulated for the purpose of determining means of safeguarding aircraft from the dangers associated with powerplant fires, he announces. These tests, he explains, will be conducted on a full-scale nacelle and stub wing, complete with engine, propeller, and accessories. The engine will be operated, and the whole set-up placed in an air stream during the tests to simulate actual flight conditions. Tests will be made on fire detectors and fire extinguishers, and also on various materials and accessories, to determine suitable designs which will present the highest degree of safety from powerplant fires, Mr. Dallas reveals.

Government aircraft technical branches were charged with "criminal negligence" for not forcing the development of safety-fuel engines, by Myron S. Huckle, Diesel Equipment Corp., the first to rise in discussion. Once such engines are available, he said, the regulatory branches can legislate volatile fuel from all commercial aircraft. All commercial airplanes engines today were developed for military engines where performance, not safety, is all-important, he continued. He stated his belief that, as there is not sufficient incentive for such a development among the aircraft builders, it must be government-subsidized.

Prof. Peter Altman, University of Detroit, found that he and Mr. Dallas were in agreement that, with a smaller rate of fuel dumping than used in the tests, combustion probably would not occur. Similarly, Mr. Dallas told another discussor, if 200 to 300 gpm were dumped, which is a considerably higher rate than used in his tests, the hazard probably would be increased.

"Safety-Fuel" Needs Explained

A long-range program of the work necessary to modify gasoline aircraft-engine installations so that they will burn the heavier "safety fuels" successfully and thus reduce fire risk, was outlined in the paper delivered at the final Aircraft-Engine Session. Enthusiastic discussion that followed centered around questions of how safe a safety fuel really is; fuel injection versus carburetion; and problems of starting. The speaker was introduced by Chairman Robert Insley.

Present Prospects for Use of "Safety Fuels" in Spark-Ignition Aircraft Engines - F. C. MOCK, Bendix Products Division, Bendix Aviation Corp.

RECENT developments in fuel-refining processes have developed new safety fuels, and have revived general interest in the subject, Mr. Mock reports. "Safety" or fireproof aircraft fuels, he explains, must be less volatile than gasoline and should have a flash point of about 105 F, a distillation range between 375 and 475 F, and about 87 octane rating. In his paper he summarizes the program probably necessary before such fuels can be employed successfully in every-day service operations.

Mr. Mock emphasizes that many of these heavy fuels have a lower heat value than that of gasoline; hence vaporization must be complete and

fuel-air metering accurate, to make their competition with gasoline possible.

Three methods of fuel feed are discussed: injection into the cylinder, into the intake pipes, and into the supercharger. Injection into the cylinder, he reports, has been tested on a full-scale engine on the dynamometer with some success, but it was not flown. Injection into the supercharger, he feels, is attractive because of its simplicity.

Five detail problems are listed: injection equipment; changes in engine and cylinder; fuel-air metering and power control; starting; and installation. Of these, Mr. Mock remarks that the injection equipment and fuel-air metering and power control are well developed; changes in engine and cylinder have been started; and starting remains to be solved.

He concludes that safety fuel can be used but not without considerable research taking three or four years, which will eventuate in certain changes in engine design.

Posing the question: "How safe is safety fuel?" Dr. Graham Edgar, Ethyl Gasoline Corp., contended that a fire can start by spillage of safety fuel on a hot surface that would not occur with gasoline. To back his claim he reported test results that showed that high-octane safety fuel ignited at a lower temperature when spilled on hot surfaces than did high-octane gasoline. He agreed, however, that safety fuel will not ignite from a spark, and flames will not spread as fast as when gasoline is ignited.

Suggesting that the injection-equipment builders probably have not solved all the problems of injection, A. L. Beall, Wright Aeronautical Corp., asked Mr. Mock what has been done on the possibility of using air injection with a safety fuel.

Taking issue with Mr. Mock's statement that safety fuels have a lower heat value than that of gasoline, S. D. Heron, Ethyl Gasoline Corp., announced that safety fuels are now available with calorific values higher than those of gasoline. For starting on safety fuels, he recommended gaseous or volatile fuels, such as ethyl ether or petroleum ether. Mr. Heron also called attention to the possible use of an electric cracking unit in the piston.

Further information on the high-heat-value safety fuels was contributed at this point by W. J. Sweeney of Standard Oil Development Co. There are two general types of safety fuels, he explained - the aromatic and the paraffinic. The paraffinic can have a higher heat value than average aviation gasoline of the same octane number, he continued, so Mr. Mock probably was referring to the aromatic safety fuels. Even the aromatic safety fuels, he added, may have a higher heat value on a gallon basis.

Safety fuel will have to be kept pretty warm for satisfactory burning, according to Dr. D. P. Barnard, Standard Oil Co. (Ind.), who based his statement on the high boiling and flash points of safety fuel as compared with gasoline.

W. H. Hubner, Universal Oil Products Co., veered the discussion on a different tack when he asked the opinions of engine builders and Government men on the future of fuel injection in this country. I want to know, he said, whether or not we should stop work on volatile fuels and concentrate on heavier fuels. Are engine men going ahead with this development?

If we are going over to the use of hydrogenated safety fuel and injection equipment, why not go whole hog and go all the way to the diesel and enjoy its further advantages? asked Francis Masi, Naval Aircraft Factory, the first to answer Mr. Hubner.

Mr. Masi failed to mention that, in going over to the diesel, we also would get all its disadvantages, commented Oscar W. Schey, National Advisory Committee for Aeronautics. Mr. Schey reported tests that indicated that power and fuel consumption, when burning safety fuel, are about the same as when using gasoline.

That safety fuel is out of the picture for many military aircraft because of its poorer flexibility was indicated by H. A. McCullough, Naval Aircraft Factory.

Harold Caminez, Aircraft Screw Products Co., pointed out some of the problems that crop up in engine development to delay production release. For this reason he feels that fuel injection is three or four years off.

Fuel injection is now available with gasoline in small Continental aircraft engines, and these engines cost only about \$10 more than corresponding carburetor engines, revealed J. H. Geisse, Civil Aeronautics Authority. His statement that the Germans were changing over from carburetors to fuel injection in their aircraft engines was confirmed by Dr. Edgar and Chairman Insley. Today more than 60% of the German engines have been changed over, he reported.

What advantages has fuel injection to cause such a wholesale change-over to it as the Germans are now doing, in spite of the weight it adds? asked William Littlewood, American Airlines, Inc.

His question brought many answers. R. V. Kerley, U. S. Army Air Corps, explained that fuel injection will give more power or better economy, whichever is desired, because each cylinder can be controlled more accurately. Then too, he continued, fuel-injection equipment can burn a wider range of fuels, and the Germans have fuel problems that we do not have. Another discussor brought up the point that the icing problem is less acute with fuel injection.

Chairman Insley's comment that the Germans never did have as good carburetors as are produced in this country was amplified colorfully by Mr. Mock:

"The Germans built carburetors like Irishmen fiddle—by main strength," he contended; "their carburetors were simply loaded with gadgets. No wonder they went to fuel injection! They never did apply the laws of hydraulics in carburetor work."

Answering his discussors, he agreed with Mr. Beall that air injection might solve some problems; emphasized that the nozzle location must be determined by the engine builder; and repeated his contention that there is no advantage to be gained from the diesel for aircraft unless the amount of excess air that it now requires can be reduced.

Beam Stress Calculations Debated

Various methods for determining the stresses in leading-edge wing beams and a historical discussion of the development of wind tunnels leading up to an explanation of low-turbulence tunnels, comprised the varied program in the final Aircraft Session. The speakers were presented by Chairman Peter Altman.

Stress Analysis of Leading-Edge Wing Spars—PROF. J. S. NEWELL, Massachusetts Institute of Technology.

STRAIGHTFORWARD determination of the normal stresses—tensile, compressive, and shear—in leading-edge airplane wing beams may be accomplished by the procedure developed in his paper, Mr. Newell announces. Wing beams having a single shear web, located at about 30% of the wing chord, plus a stress-carrying sheet running around the leading edge, in most cases, are unsymmetrical sections and should be analyzed as such, he points out. Because of the thinness of the shear-carrying elements, he explains, special care is required in determining the distribution of the shear stresses around the cross-section.

The internal shear stresses acting upon each unit area in the cross-section are shown to result in forces that tend to twist the beam, unless there is coincidence of the lines of action of the resultants of the internal shear forces and of the external forces producing shear on the cross-section. For this reason, Mr. Newell states, it is imperative that means be provided for determining the "shear center" or "center of twist" of the beam so that the magnitudes of such torsional couples may be evaluated. He provides these means in the form of formulas, and presents an example to illustrate their use.

Chairman Altman presented some written comments submitted by Oscar Erlandsen, Jr., of the Grumman Aircraft Engineering Corp., indicating marked interest in the method set forth. The type of construction considered is thought by

the Grumman Corp., to be economical, and it was suggested that further work be directed toward determination of the allowable compression stress in the skin.

Dr. Max M. Munk, of Catholic University, inquired whether the method set forth was based on the fundamentals of the classical beam theory. Prof. Newell replied in the affirmative and added that calculation of the shear center was the point of main interest in the problem dealt with, whereas this point is known for conventional beams.

E. I. Ryder, Civil Aeronautics Authority, discussed the question of buckling as affecting the strength of the specimens analyzed and inquired about test results. He indicated the belief that the method was of value for preliminary design but should be supplemented by tests.

Prof. Newell replied that buckling had taken place at loads somewhat below those for which the calculations were made, and concurred with Mr. Ryder on the latter point.

G. L. Bryan, Jr., Glenn L. Martin Co., described an alternative system of determining the shear center which eliminated some of the lengthy computations involved.

Some Phases of Wind-Tunnel Work—H. L. Dryden, National Bureau of Standards.

IN his talk Dr. Dryden discussed the question of why wind tunnels of low turbulence are desired.

Starting with a brief description of early wind tunnels, he mentioned discrepancies observed in measured drag coefficients of spheres, and described briefly Prandtl's classical explanation of the phenomenon. He then took up modern methods of measuring the intensity and scale of wind-tunnel turbulence, and the correlation of these two into a single turbulence parameter suggested by G. I. Taylor. He showed the relation of critical Reynolds Number of spheres to this parameter as determined in a number of wind tunnels, and the significance of these results in indicating the very low turbulence existing in free air. He then discussed the general trend of wind tunnels toward lower turbulence and the significance of this trend in leading to improved understanding and prediction of aerodynamic characteristics in flight.

In conclusion, he exhibited the classical laminar and turbulence skin friction curves, and discussed briefly the significance of the transition point in practical aerodynamic problems.

In commenting on Dr. Dryden's talk, Dr. Munk gave a historical discussion of a number of well-known wind tunnels and stated the belief that a present need is the application of much the same criteria in wind-tunnel design as in airplane design, that is, to reduce the power required to achieve a certain performance.

Supplementing his paper, Dr. Dryden stated that the research he had discussed had been conducted by the National Bureau of Standards in cooperation with the NACA and with several universities, through which cooperation a fundamental investigation of the effects of turbulence in fluid motions was being carried out.

T. P. Wright, Curtiss-Wright Corp., mentioned a paper delivered by Prof. B. M. Jones a number of years ago setting up a criterion for the streamlined airplane as having no greater skin friction than that of turbulent flow on a flat plate and reported progress toward this objective. He added that, as the result of recent work by Dryden, Jones, and others, it now appeared that it might be possible to exceed 100% on the basis of the former criteria and that the standards could therefore be raised. He asked Dr. Dryden for a definition of the various terms that he used in connection with turbulence.

Dr. Dryden replied by stating that there seems to be some inconsistency in saying that turbulence in a wind tunnel causes the onset of turbulence in a boundary layer. He therefore prefers to call the unsteady type of flow in a boundary layer "eddy" and to reserve the term turbulence for known uniformity in the flow in a free stream. He also described briefly laminar flow and the transition from laminar to "eddy" flow.

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between Feb. 15, 1939, and Mar. 15, 1939.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Buffalo Section

BARRESE, LOUIS (A) fleet operation, Rochester Packing Co., 900 Maple St., Rochester, N. Y.
MARQUARDT, WM. C. (A) junior engineer, Houde Engrg. Corp., Buffalo, N. Y. (mail) 152 Hamlin Road.

Cleveland Section

FEISS, GEORGE JAMES (A) president, general manager, Superior Foundry Co., 3542 East 71st St., Cleveland.

Dayton Section

BLANCHARD, W. J. (M) president, Engineering Projects, Inc., 228 East First St., Dayton, O.
SCHMIDT, RICHARD B. (M) tool design department, International Harvester Co., Springfield, O.

Detroit Section

BLOCK, CHARLES L. (J) draftsman, U. S. Rubber Co., Detroit (mail) 2685 Lawrence Ave., Detroit.
DAHLQUIST, HENRY (A) sales representative, 692 Henrietta St., Birmingham, Mich.
MORSE, CLAUDE A. (A) sales representative, Tung-Sol Lamp Works, Inc., 5-150 General Motors Bldg., Detroit.
PLACE, CHARLES E. S. (M) sales engineer, National Machine Products, 4850 Bellevue, Detroit (mail) 25 Highland Ave., Highland Park, Mich.
SMITH, TORRANCE B. (M) service engineer, American Brass Co., Detroit (mail) 174 South Clark St.

Indiana Section

BANCROFT, RICHARD H. (M) metallurgist, Perfect Circle Co., New Castle, Ind. (mail) Rural Route 5.
BRADY, THOMAS ROBERT (A) factory manager, American Bantam Motor Car Co., Butler, Pa. (mail) 66 East Regent St., Indianapolis.
HEHNER, N. E. (M) chief engineer, Prest-O-Lite Storage Battery Corp., Indianapolis.

Metropolitan Section

WILLS, JACKSON T. (J) experimental test engineer, Wright Aeronautical Corp., Paterson, N. J. (mail) 431 Broadway, Apt. 16-A.

Milwaukee Section

HANNERS, HARVEY W. (M) 1140 Wisconsin Ave., Beloit, Wis.

New England Section

DINUCCI, ANTHONY V. (A) automotive instructor, Waltham Trade School, Waltham, Mass. (mail) 98 Bayswater St., East Boston, Mass.

Philadelphia Section

AUERBACH, S. MORTIMER (A) 801 N. New Hampshire Ave., Atlantic City, N. J.

JOHNSON, WALTER F. (A) president, Johnson & Towers, Inc., 113-115 Market St., Phila. (mail) 326 Chestnut St., Moorestown, N. J.

St. Louis Section

EWART, WILLIAM M. (M) factory manager, Carter Carburetor Corp., 2840 N. Spring Ave., St. Louis, Mo.
ROSS, HARRY HILAND (M) industrial representative, Sinclair Refining Co., 1301 Gratiot St., St. Louis, Mo. (mail) 2306 Klemm Ave.

Southern California Section

PAYNE, CHARLES E. (J) draftsman, MacClatchie Mfg. Co., P. O. Box 430, Compton, Calif. (mail) 839 Virginia St., El Segundo, Calif.

Washington Section

HAMILTON, DONALD MENZIES (SM) engineer, U. S. Forest Service, 930 F St., N. W., Washington.

Outside of Section Territory

BOTNEN, KARL ORVILLE (SM) instructor, Post Motor School, U. S. Army, P. O. Box 69, Schofield Barracks, T. H.
BOULTON, JOHN WM. (A) owner, Yow Brake Service, 320 N. W. Sixth, Oklahoma City, Okla.

KESTERSON, TOM O. (A) senior pilot, charge of aviation development, Tennessee Valley Authority, P. O. Box 1145, Knoxville, Tenn.

NELSON, CLARENCE W. (A) equipment and mechanical foreman, U. S. Bureau of Biological Survey, Middle River, Minn.

Foreign

BRADBURY, CYRIL HENRY (FM) experimental engineer, Ruston & Hornsby, Ltd., Lincoln, England (mail) "Woodlands" 75 Doddington Road.

JUNG, ERNST (A) Hamburger Mineralol-Import, Alsterdam 16-18, Hamburg 1, Germany.

KIRKHAM, NORMAN H. (FM) transport officer, Texas Co. (Australasia) Ltd., P. O. Box 2004, Wellington, New Zealand.

LE GALLIEN, CHARLES LOUIS (FM) mechanical and automotive engineer, 317A-319 Pacific Highway, North Sydney, N.S.W., Australia.

NEWTON, JOHN WOOD (A) managing director, Enwood Steel Products, Ltd., Prudential Bldg., Queen St., Nottingham, England.

RIETHMULLER, MARVIN (A) garage foreman, Redman Motors, 230 Margaret St., Toowoomba, Queensland, Australia (mail) 195 Russell St.

SMITH, EDWARD MITCHELSON (FM) Thornycroft (Australia) Pty., Ltd., 6/10 Wattle St., G.P.O. Box 2622 EE, Sydney, N.S.W., Australia.

STADLER, ALFRED E. (J) assistant to mechanical superintendent, Cape Provincial Roads Dept., P. O. Box 2603, Cape Town, Union of South Africa.

Applications Received

The applications for membership received between Feb. 15, 1939, and Mar. 15, 1939, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

MAU, STUART LEHMAN, training for sales engineer, Osborn Mfg. Co., Johns Conveyor Division, Cleveland.

MORIARTY, WILSON H., sales engineer, National Malleable & Steel Castings Co., Cleveland.

POND, BENHAM S., transmission project engineer, Acrotorque Drive & Power Co., Cleveland.

Dayton Section

DETTMER, ALBERT B., assistant to president, The K-D Lamp Co., Cincinnati, O.

Detroit Section

COULTER, CLAYTON L., inspector and assistant, War Department, Detroit Ordnance District, Detroit.

GASTON, GEORGE B., Jr., stylist, designer, Stinson Aircraft Division, Aviation Mfg. Corp., Wayne, Mich.

HILL, HARRY O., sales engineer, American Bosch Corp., Detroit.

HUFF, ELDRED H., plant superintendent, Stinson Aircraft Division, Aviation Mfg. Corp., Wayne, Mich.

JACQUES, LEO G., Motor Products Corp., Detroit.

PLATZ, HENRY THOMAS, engineer of tool and fixture division, Briggs Mfg. Co., Detroit.

QUALMAN, JACK W., draftsman, Chevrolet Motor Co., Detroit.

SAHLSTRAND, LIEF YNGVE, student engineer, Chrysler Corp., Highland Park, Mich.

SCHWILK, FREDERICK FRANK, sales supervisor, Continental Motors Corp., Detroit.

THOMPSON, RANSOM S., engineer, Skinner Motors, Inc., Detroit.

Indiana Section

FISHER, WILLIAM A., vice president and service manager, C. H. Wallerich Co., Indianapolis.

STANLEY, ROWLAND I., research engineer, Perfect Circle Co., Hagerstown, Ind.

(Concluded on page 31)

Baltimore Section

RAPLEYEA, GEORGE W., consulting engineer, 2514 Harford Road, Baltimore.

Canadian Section

BEATTIE, FREDERICK J., sales manager, Wallace Barnes Co., Ltd., Hamilton, Ont.

CONN, HUGH GORDON, lecturer, Queen's University, Kingston, Ont.

GILMOUR, JOHN P., sales, Collins & Aikman of Canada, Ltd., Toronto, Ont.

JONES, FREDERICK G., auto parts, salesman, Bennett & Elliott, Ltd., Toronto, Ont.

Chicago Section

ERICKSON, GILBERT, engine tester, International Harvester Co., Tractor Works, Chicago.

SMITH, JOHN, superintendent of maintenance, Pennoyer Merchant Transfer Co., Chicago.

WILCOX, RALPH L., metallurgist, New Jersey Zinc Sales Co., Inc., Chicago.

Cleveland Section

GILLET, HARRY, JR., manager, sales engineering department, Standard Oil Co. (Ohio), Cleveland.

JOHNSON, ROBERT STEVENS, engineer, Timken Roller Bearing Co., Canton, O.

News of the Society

Wolf's Paper on Filters Draws Active Discussion

● Philadelphia

Austin M. Wolf brought to the Philadelphia Section's February meeting his paper, "Filtering Fallacies," which was so well received when presented before the Society's Annual Meeting in Detroit. He also gave a complete rebuttal to numerous questions fired from the ranks of an interested audience. Mr. Wolf, who has twice been chairman of the Metropolitan Section and has served as a member of the Society's Council, conducts a general consulting practice and is automotive consultant and director of standards for New York State. He was introduced by B. B. Bachman, vice-president and chief engineer, Autocar Co., who presided at the meeting.

A digest of Mr. Wolf's paper is included on page 33 of the February Journal in the report of Annual Meeting activities. As when the paper was first presented, Mr. Wolf's comments stimulated considerable discussion from the floor.

The first discussor drew chuckles when he dryly commented at the outset of his remarks, "I don't think the automobile engine will work." He continued to say that we can't expect a filter to overcome the design shortcomings of an engine. The point was added that the oil filter is an excellent device as developed today and when serviced properly will do a satisfactory job.

Issue was taken with the statement that development of modern methods of high finish have decreased working clearances between component parts of the internal combustion engine. The view was expressed that finer finish has made it possible to determine proper clearances and to build them into the powerplant. "Finish today," said one commentator, "enables us to use larger clearances initially."

Another member of the audience laconically remarked that the average user of an oil filter expects it to do everything "from putting metal back on the cylinder walls to taking the squeak out of the brakes." He described the operations in one fleet of trucks in which each long-haul unit covers 2500 to 3000 miles weekly and filters are used to good advantage. However, in the same fleet a number of pick-up trucks are used for city deliveries and it has been found pointless to attach filters. The pick-up trucks described were said to have a life span of approximately three years, being subjected to such severe service punishment that bodies and other component parts virtually fall to pieces before the engines are worn appreciably.

Complimenting Mr. Wolf on his paper, another member of the audience confessed that it appeared to him that, "All a fleet operator can get from 'Filtering Fallacies' is a bad dream." This discussor suggested, as a simple means of chasing the fleet operator's nightmare, that an oil sampling device should be installed

on several trucks in the fleet. Drivers would be given instructions, he said, to draw a 4 oz sample about every 300 miles of operation. Test tubes containing these samples could be lined up in the sampling order and visual inspection would provide a quick check. "This method," said the discussor, "naturally would not tell anything about acidity and dilution, but it would indicate the life of the filter element during the time it is fulfilling its basic requirement, which is to remove dirt from the oil."

Discussors of Mr. Wolf's paper were Mr. Bachman, Walter C. Bauer, Briggs Clarifier Co.; E. B. Headden, Motor Improvements, Inc.; C. H. Van Hartesveldt, Atlantic Refining Co.; Charles O. Guernsey, J. G. Brill Co.; and J. G. Moxey, Petroleum Truck Service, Inc.

Some 25 engineering students attending Villanova College were guests of the Section at this meeting. Each month a group of engineering students from one of the colleges in the Section territory is invited to attend the Section's meeting.

SAE Guides International Aircraft Standardization

The SAE has assumed technical leadership in a program through which the leading aeronautical organizations of this Country plan to participate further in the development of international standards in the aeronautic field. Participation in international aircraft standardization has been carried on by the SAE for the past few years by representation at the meetings of Committee 20 on Aeronautics of the International Standards Association.

At a recent conference of the interested organizations called by the American Standards Association, it was decided that the international work would be done through the American Standards Association which is a member of the ISA, a federation of the national standardizing bodies of 26 countries, and it was recommended that the ASA organize an American Sectional Committee to provide effective American participation in the international work.

At this conference Arthur Nutt, Wright Aeronautical Corp., was appointed chairman of an ASA Advisory Committee for Aeronautics for carrying out the standardization project. For many years Mr. Nutt has served as chairman of the Aircraft-Engine Division of the SAE Standards Committee. At a subsequent meeting of this Advisory Committee it was recommended to the ASA that the SAE be designated to sponsor the American Sectional Committee for carrying out the project.

The American Sectional Committee, working through direct representation on Committee 20 of the ISA, will carry out the international standardization work, making available for international acceptance the standards agreed

SAE Participates in Preparedness Dinner

Assistant Secretary of War Louis Johnson will address the National Industrial Preparedness Dinner, Waldorf-Astoria Hotel, New York, April 5. The SAE is one of the engineering and military organizations sponsoring the affair, and is represented on the general committee by Col. H. W. Alden, chairman of the SAE Ordnance Advisory Committee.

Tables are arranged to accommodate 10 guests each, at a charge of \$7.50 per place or \$75 per table. Reservations should be made through Hartley W. Barclay, secretary, American Conference on National Defense, 205 East 42nd Street, New York, N. Y.

upon by the American participating organizations.

Plans for the international work include agreement on sizes and specifications for the more commonly used parts of airplanes, airplane engines, and fuel specifications as formulated by Sectional Committee Z-11, organized under ASA procedure. The standards also will include methods of test and nomenclature relating to aircraft.

Decision to participate in aircraft standardization on an international scale was based upon the belief of the conference that such work will lead to important economies and other advantages to the American aircraft industry.

Worldwide agreement on parts will alleviate many serious problems which American manufacturers now face in providing and servicing the engines and aircraft which they sell abroad. It also will reduce the large number and variety of models and parts that have to be manufactured for export today. International standards, by making parts interchangeable, also will widen export markets.

Informal conferences of American and foreign representatives to discuss international aircraft standards have been scheduled to take place during the SAE World Automotive Engineering Congress, in May, 1939, in preparation for the formal meeting of ISA Committee 20 on Aeronautics in Helsingfors, Finland, June, 1939.

Herrington Talks on Military Motor Vehicles

● Indiana

The development of military motor vehicles that will have the ability to "carry on" even though roads should disappear through systematic airplane bombing, as they have in Spain, is one of the basic problems facing nations preparing for future war, Col. A. W. S. Herrington, president of the Marmon-Herrington Co., told members attending the March 10 meeting of the Indiana Section in his paper, "The Automotive Equipment of a Modern Army." These off-the-road light tanks and wheeled vehicles, he declared, must have speed and maneuverability, and must therefore be built with strong, lightweight metals.

While foreign countries are handicapped because they have no real mass-production abilities and are lacking in some of the essential raw materials, Col. Herrington said, certain of them are building ahead. This, he pointed out, causes heavy obsolescence of vehicles on hand as new designs are developed.

In America, he said, we have the ability and materials to build these machines as fast as we can man them, but it is very necessary for

us to have designs ready in advance and to keep improving these designs. Should war come, he said, research, both for automotive ground equipment and airplanes, will cease the moment it starts. We are fortunate, he added, in not being handicapped, as are some nations which have to save all of their better steels for their air forces.

'Superfinish' Explained By Chrysler Executive

● So. California

How the Chrysler Corp. discovered a new finishing process that makes it possible to obtain an unusually high finish, accurate to a few millionths of an inch, in a very short time, was told by D. A. Wallace, president, Chrysler Sales Corp. and one of the originators of the process, before more than 200 at the March 6 meeting of the Southern California Section in Los Angeles.

We were looking for a solution to the problem of "fuzz" deposits from wear, he explained, and to the problem of scratches in finished components, or rupture of the parent metal, especially as applied to automobile and railroad bearings.

Mr. Wallace defined "Superfinish" as "an extremely fine surface finish produced upon flat, internal, external, round, concave, convex, and other types of surfaces by a combination of short motions, light abrasive pressure, slow abrasive cutting speeds, hard abrasive stones, and a lubricant of proper viscosity, that eliminates the scratches and surface defects created by previous mechanical operations, without creating scratches or defects in the Superfinished surface that is produced." More briefly, he said, the finish is produced by stones, similar to those used in honing, that are given three or more simultaneous motions; a rapid oscillating motion is always involved. When the desired limit of finish is not under 3 micro-in., he explained, the operation usually requires only from 3 to 30 sec; pressure is very low from a few ounces to a few pounds per square inch.

The lubricant is used for washing away the fine cuttings from the superfinishing operation, Mr. Wallace indicated. As a result, he pointed

out, the minute surface ridges of previous mechanical operations are practically removed to the point where the smooth base metal is reached. He submitted data to show the large reduction in wear effected by the use of superfinish for various moving parts.

Discussion took the form of a series of questions and answers with Mr. Wallace on the answering end. Asked whether superfinish would stop gumming, his reply was "no"—that it does not overcome metallurgical defects or the results of inferior lubricants. So far, he replied to another discussor, free-wheeling clutches have not been superfinished, but it is becoming common practice to superfinish ball bearings, propeller gear teeth, and ammunition shells.

Airlines Called Defense Adjunct

Control of the political destinies of the world will be held in the future by that nation which best employs its air force in every-day commerce and development, predicted Major J. L. Stromme, procurement planning representative, U. S. Army Air Corps, at the Feb. 15 meeting of the Southern California Section in Los Angeles. Representatives from virtually every company in the Southern California aircraft industry evidenced their vital interest in the Major's subject: "The Military Value of Commercial Aviation."

Having the greatest number of efficient and well-manned aircraft alone will not suffice, he continued, recounting from history the rise and fall of nations that failed to utilize in commerce those forces upon which they depended for defense.

The United States, which has continued to lead the world in the development of superior performance, efficiency, range, and safety, should therefore have a decisive advantage in the coming struggle for control of the trade routes of the air, he contended. Superiority of aircraft resulting from organized and fundamental research will be a vital factor, he indicated.

Commercial aviation, in reality, is a flying laboratory out of which come new developments, more efficient equipment, and capable pilots, he declared. In an emergency in this country, he reported, the airlines can provide 600 trained pilots, 1000 additional airplanes of the latest type for carrying troops or equipment,

and nearly 2400 air terminals for air bases or repair units.

The 500 to 700-mph airplane powered by a 3000-hp engine is coming, Major Stromme believes. Speaking of military tactics, he opined that the day of the airplane "dog fight" is gone and that bombing will be done from the stratosphere.

Major Stromme's talk was followed by motion pictures of the Douglas DC-4, stressing its development, fabrication, and testing. The pictures were presented and explained by Lieut. Fred L. Vincent, assistant to Major Stromme.

The first subject brought up in discussion was the proper use of oxygen. Major Stromme told his questioners that the effects of using oxygen might be noticed by passengers coming down too suddenly. An altitude of 16,000 ft is about the time to take oxygen without getting a "head," contributed Capt. William A. F. Millinger, U. S. Army Air Corps, who served as chairman of the meeting. When oxygen is taken at this point, he continued, the mind is kept fairly clear at 25,000 to 30,000 ft. He then described some photographic work he is doing at these altitudes, using oxygen.

Navigation in the stratosphere is done by celestial navigation, the earth being rarely seen, Major Stromme explained to one discussor.

Another discussor, C. F. Lienesch, spoke of bomb-proofing and shrapnel-proofing aircraft buildings.

Taking as his theme "Knowledge by Experience," Chairman Millinger, in a short introductory talk, stressed his belief that our further education in combat airplanes must come through actual war; just as we had to learn much about military planes from our Allies in the Great War.

Cites Advances in Commercial Aviation

● New England

Safety and dependability cannot be over-emphasized in commercial aviation, John Bunce, service manager, Pratt & Whitney Aircraft Division of United Aircraft Corp., declared at the March 14 meeting of the New England Section. Flying schedules must be maintained, he said,

Southern Californians Get Low Down on Superfinish



Members of the Southern California Section inspect a table model "Superfinisher" on display after the meeting.



D. A. Wallace, president, Chrysler Sales Corp., answers questions after presenting his paper on "Superfinish" at the Southern California Section's March Meeting.



Engineers compare parts which had been Superfinished with parts finished by other production methods.

and any breakdown that causes delay results in a tremendous revenue loss.

In continuing he spoke of the great advances which have been made in commercial aviation in recent years, citing increasing periods between engine failures, decreasing maintenance costs, refinements in design, the drop in engine cost per horsepower, and lowered fuel costs. These and other factors, he said, have put commercial aviation on a paying basis.

The mysteries of Polaroid lighting were explained to members of the New England Section on Feb. 14 by Parker Hamilton. He told how the glass is made and then, with slides, showed just how the light rays are combed out to prevent glare.

Using an ordinary motor headlamp he first showed the bright glow. Then placing a Polaroid lens in front of the other one the bright lights seemed almost out, although objects in front were well illuminated. There was no more eye strain than looking at a full moon.

Mr. Hamilton stated that with a Polaroid windshield the whole of an approaching car provided with Polaroid lenses on the headlamps can be seen—license plate, radiator and even exhaust fumes from the rear. Pedestrians are seen as well as if no car were approaching, because there is no shocking glare in the driver's eyes. It gives a sense of daytime security and comfort, he added.

Then he told of the many other uses to which Polaroid is now being put. He said the cost at present is one factor handicapping its sale for motor cars; but that with added sales volume the price will naturally decrease.

Students Read Papers In SAE Competition

• No. California

Students representing the four San Francisco Bay District engineering universities took the floor at the Northern California Section's March 9 dinner meeting held on the University of California campus, which was devoted to the annual student paper competition.

"The Design and Construction of a Photoelectric Wave Generator and its Application to High-Speed Engine Indicators," was the unique topic of the paper which won the first award, a cash prize, for its author, A. R. Champion, of the University of California. The apparatus described consists of a cathode-ray oscillograph in which the horizontal and vertical sweeps are each controlled by a separate photoelectric cell and light system, so that when used in conjunction with a quartz crystal, or similar type of engine indicator, a pressure volume diagram is projected on the cathode ray screen.

Other participating students were presented with a paid-up, one-year student membership in the society.

F. T. Collins, of Stanford University, gave a noteworthy paper on the "Oiliness of Oil." He stated that oiliness is purely a problem of physics and chemistry and discussed it from that viewpoint. The definition of oiliness has been a subject of controversy for some time, he said, and suggested the term "molecular hesivity" as a substitute, since this term is derived from the Latin "hesito" which means "stick fast." Since oiliness is defined as the ability of the molecules of oil to adhere to metallic surfaces it was agreed that this term is a good contribution.

C. Arismendi, of Santa Clara University, delivered a very practical paper on the use of reclaimed oil. He quoted figures which indicated that 20% of the total oil consumed by some fleets is reclaimed at a cost of approximately one-half the cost of new oil. The overall result of such a practice would therefore reduce the total crankcase oil expense by 10%, he said.

J. H. Connolly of the Oakland Polytechnic

College discussed "Supercharging the Light Automobile." He reviewed the development of superchargers of the Vane and Roots blower types and quoted performance figures on their use in internal combustion engines. He predicted that one of these two types would probably be manufactured and used for light automobiles within a short time, because of the increased operating efficiency resulting from better fuel distribution.

Prof. Carl J. Vogt, of the University of California, illustrated with slides, tests which are being conducted at that school to study the injection characteristics of both hydraulically and magnetically operated diesel injectors. His data showed that the magnetically operated injector produces a constant spray which is free from surges and oscillations and he stated that in engine tests it produced more uniform firing.

At the completion of the papers, the members visited the various engineering laboratories of the University where demonstrations were made of: diesel nozzle spray under a stroboscope; variable compression engine; self-ignition of diesel oils; photoelectric wave generator for engine indicator; photoelectric photometer; headlight glare resistance tester; and legibility of license plates.

The meeting was arranged and conducted by Prof. L. M. K. Boelter, head of the mechanical engineering department, University of California, and was conceded to be the most outstanding student meeting in many years.

The Terrace Ball Room of San Francisco's famous Fairmont Hotel provided the setting for Northern California Section's annual dinner dance, Feb. 11. Not a thought was given to technical papers by the 380 members and guests who enjoyed the entertainment, the dinner, and the dancing. William S. Crowell, secretary of the Section, headed the committee which made this party one of the outstanding social events of the season.

Chrysler Acquired Fluid Flywheel Patents in 1933

• Dayton

How the Chrysler Corp. has been developing the fluid flywheel, incorporated in its 1939 Chrysler Imperial models, since it acquired the American patents of the Sinclair organization of England in 1933, was revealed by A. Elliott Kimberly of the Chrysler Corp. at the March 10 meeting of the Dayton Section at Ohio State University. The Sinclair organization, he stated, was the first to apply the fluid flywheel to motor vehicles in 1912; originally using it on buses to dampen the torsional impulses of the engine. In 1928, he said, the fluid flywheel was introduced in passenger cars on the Continent.

At the time that the Chrysler organization obtained these patents, Mr. Kimberly explained, aluminum castings used in the fluid flywheel were not found to be altogether satisfactory. Therefore, he continued, development of a stamped, welded, steel construction was undertaken, which resulted in the present fluid clutch.

The primary advantages of the fluid flywheel, said Mr. Kimberly, are that it: eliminates 90% of gear shifting; dampens torsional vibrations; decreases tendency to skid on slippery roads; decreases wear and tear on clutch, gears, propeller shaft, differential, and axles; and eliminates the necessity of "feathering" the clutch.

In tracing the history of the fluid flywheel, the speaker noted that it was developed from the hydraulic coupling which was conceived in 1906 or 1907 and first used on ocean vessels as a speed-reduction torque converter. Speed reduction was necessary, he said, because with direct drive the turbine speed would be too low for maximum efficiency and the propeller speed too high.

A demonstration followed at the University's Robinson laboratory, where a Chrysler Imperial

was placed on a chassis dynamometer and road conditions of 30 mph simulated. A small transparent model of the fluid flywheel was also on display and by use of a stroboscope the motion of the fluid at various torques and speeds was studied.

The SAE Student Branch at Ohio State University cooperated with the Dayton Section in holding the meeting. Student Branch members assisted in the laboratory demonstrations and Student Branch chairman and field editor, Thomas A. Seddon, reported the meeting. K. W. Stinson, professor of automotive engineering at the University, presided in the absence of Section Chairman Louis Poock. Mr. Kimberly, the speaker, is an Ohio State alumnus.

Diesels Seen Gaining as Powerplants for Ships

• Washington

Galley slaves rowed the Romans, wind and canvas brought Columbus to America, the demon steam has ruled since Fulton, and now—according to John E. Schmeltzer, speaking before a record attendance of the Washington Sections of the SAE and ASME, Feb. 14—the golden door of opportunity is open to the diesel motor ship.

The United States Maritime Commission, according to Mr. Schmeltzer, who is assistant director of the Commission's technical division, is carrying out its mandate to provide American ships, built in America and manned by American crews, in sufficient number to carry our seagoing commerce and a proper share of foreign tonnage. It is building ships with a variety of powerplant installations and giving the diesel motor ship a full opportunity to show its worth.

The Maritime Commission, he declared, is proceeding with all possible haste on a program which will continue for a period of years. The outcome should be a merchant marine which will satisfy the needs of commerce and provide a valuable adjunct for the Navy.

Competition between the steam and the diesel is keen, Mr. Schmeltzer stated. The steam plants, he noted, are going to higher pressures and superheats and the diesels to higher speeds and supercharging. Steam powerplants have improved considerably and are still the mainstay of the largest ships, but diesels are gaining ground, the speaker declared.

It is Mr. Schmeltzer's opinion that "any real progress in marine diesel installation must be accompanied by the development of a more satisfactory coupling and it behooves the mechanical and diesel engineers to spend a little midnight oil on this problem and not leave it on the doorstep of the marine engineer for solution." Hydraulic couplings are largely used, he said, but are not entirely satisfactory because of loss of power which cuts down overall efficiency. Magnetic couplings, he noted, are also being used to some extent and provide a flexible and easily controlled connection, but are somewhat heavy. Mechanical couplings are small and light but transmit torsional vibrations, he added.

"With the wide use of the home oil burner and with the automotive diesel coming into use," he stated, "there will soon be a greater demand for distillate than for gasoline. (This is admitted by the refineries.)" And when planning a motor ship with a life of 20 years, he noted, one must consider the future market price and the source of the fuel supply. Steam plants will handle the residue left after the distillates are removed from petroleum, but most diesels will not.

A. C. Rohen and C. W. Fleischer, both of the Maritime Commission, expanded the paper of their chief, when called upon for remarks.

J. F. Fox presided at the meeting and E. C. Madgeburger, of the Navy Department, led the

discussion in which Harte Cooke, diesel division, American Locomotive Co., stated that the early fears of short life for the faster running diesel engine have not in general been fulfilled. He described a 600-hp 700-rpm engine which ran for 29,000 hr with no measurable wear. He described another engine of 600 hp which showed a better condition after a period of supercharged operation at 900 hp than a similar engine at its rated 600 hp.

The 2-cycle engine, he said, has considerable advantage over the 4-cycle engine in the larger sizes. The excess air used in scavenging, he explained, usually appears to be a loss, yet the additional cooling provided by the passage of the air helps to increase the charge and the power output of the engine.

F. P. Crutzner, Fairbanks, Morse & Co., expressed faith in the medium-speed engine for heavy-duty continuous service, one main advantage being its ability to use a wide variety of fuels. Some of the Fairbanks-Morse installations, with equipment for recovering and utilizing the heat in the exhaust and the water jacket, show an overall efficiency of 85%, he noted.

W. F. Joachim, from the Naval Laboratory at Annapolis, agreed with all the comment that had been made in regard to fuels. The ability of engines of apparently similar designs to handle low-grade fuels, he said, may differ widely, due to slight differences in some of the factors that affect the mixing and burning of the fuel and air.

There seems to be a trend among the engine builders and users, especially in the truck and bus field, towards tightening up on their fuel specifications, he added.

In general, it was brought out, the slow-speed engines will handle fuels from 50 to 200 sec viscosity and cetane ratings as low as 30 to 35. Engines of 700 rpm in general, require a fuel of not over 70 sec viscosity. Engines running at 1500 to 2500 rpm require fuel with a cetane rating of 45 to 55 and a viscosity of around 35 sec.

M. J. Reed, secretary of the Diesel Engine Manufacturers Association; Com. F. A. Hunnewell, of the U. S. Coast Guard; and Louis R. Ford, editor of *Motor Ship*, also submitted discussion.

Commander Hunnewell related what he called his favorite story of the M.I.T. student who was working a problem in horsepower. When asked by his professor how he was getting along he replied that he seemed to be making out all right but that the answer was coming out in gallons.

It was noted that this is something for all of us to think about when two independent estimates put our known petroleum reserve as only 13 billion barrels and we are taking about a billion barrels a year from the ground.

New Officers Elected By Student Branch

● Ohio State

On March 3 the SAE Student Branch at Ohio State University elected officers for the Spring Quarter. The new chairman is Thomas A. Seddon, who is also SAE Journal field editor for the Branch. Other officers are John M. Heldack, vice-chairman; K. O. Friley, treasurer; and Thomas J. Cook, secretary.

The Student Branch had a full day on March 10. In the afternoon, as members of the automotive section of the laboratory groups, they visited the Columbus sewage disposal plant to inspect three new gas engines that are about to be put into operation. They are planning to pay a return visit at the times the engines are started. In the evening they attended the meeting of the SAE Dayton Section which was held on the University's campus, which is reported elsewhere in "News of the Society."

SAE *Coming* EVENTS

World Automotive Engineering Congress

May 22-June 8

(Complete program on pages 12-16,
SAE Journal, March, 1939)

Baltimore - April 12

Longfellow Hotel; dinner 6:30 p.m. A Discussion of the Problem of Large Fleets - F. K. Glynn, engineer (operation and maintenance of automotive equipment), American Telephone and Telegraph Co.

Canadian - April 13

Prince Edward Hotel, Windsor, Ont.; dinner 7:00 p.m.

Chicago - April 14

Medinah Club, 505 N. Michigan Ave.; dinner 6:30 p.m. Annual Ladies' Night.

Cleveland - April 10

Closed meeting at Nela Park, for SAE members only. Safe Seeing with Automotive Headlamps - V. J. Roper, engineer, General Electric Co.

Detroit - April 10

Hotel Statler; dinner 6:30 p.m. Closed meeting, for SAE members only. Two- and Four-Cycle Diesel Engines. F. G. Shoemaker, chief engineer, General Motors Corp., will talk on Two-Cycle Diesels, and O. D. Treiber, chief engineer, Diesel Division, Hercules Motors Corp., will talk on Four-Cycle Diesels. W. J. Davidson, Diesel Engine Division, General Motors Corp., and president of the SAE, will be the guest of the Section at this meeting.

Indiana - April 13 and 28

April 13. Antlers Hotel, Indianapolis; dinner 6:30 p.m. The Civil Aeronautics Authority's Radio Experimental and Research Project at the Indianapolis Municipal Airport - Richard C. Gazley, chief, Technical Development Division, Civil Aeronautics Authority.

April 28. Afternoon and evening meeting at Purdue University, West Lafayette, Ind. Visit to the Laboratories of the Purdue University in the afternoon, with a student paper contest in the evening between the Students of Purdue University and Armour Institute of Technology in the evening.

Metropolitan - April 13

Hotel New Yorker, New York City; dinner 6:30 p.m. The Automotive Two-Cycle Diesel Engine - W. J. Davidson, General Motors Corp., and president of the SAE.

Milwaukee - April 14

Milwaukee Athletic Club; dinner 6:30 p.m. Concrete Transportation Problems on a Large Construction Project - Charles Ball, chief engineer, Chain Belt Co.

New England - April 11

Engineers Club, Boston, Mass.; dinner 6:30 p.m. Superfinish and Why It Minimizes Wear - A. M. Swigert, Jr., in charge of production research, Chrysler Corp.

Northern California - April 11

Hotel Bellevue, San Francisco; dinner 6:30 p.m. Low-priced Private Airplanes - W. B. Stout, president, Stout Engineering Laboratories.

Northwest - April 14

Hotel Mayflower, Seattle; dinner 6:30 p.m. Determining Airplane Stresses Photo-elastically - B. F. Ruffner, associate professor of aeronautical engineering, Oregon State College.

Oregon - April 14

Portland. Preview of recently developed forest preservation equipment, oil filter testing, equipment demonstrations, and discussions on maintenance problems.

Philadelphia - April 12

Engineers Club.

St. Louis - April 21

Debate at Washington University. Subjects: Two-Cycle vs. Four-Cycle Diesel Engines, and Front Engine vs. Rear Engine Mounting.

Southern California - April 15

New Breakfast Club, 3201 Los Feliz Blvd., Los Angeles. Dinner dance 6:30 p.m.

Southern New England - April 5

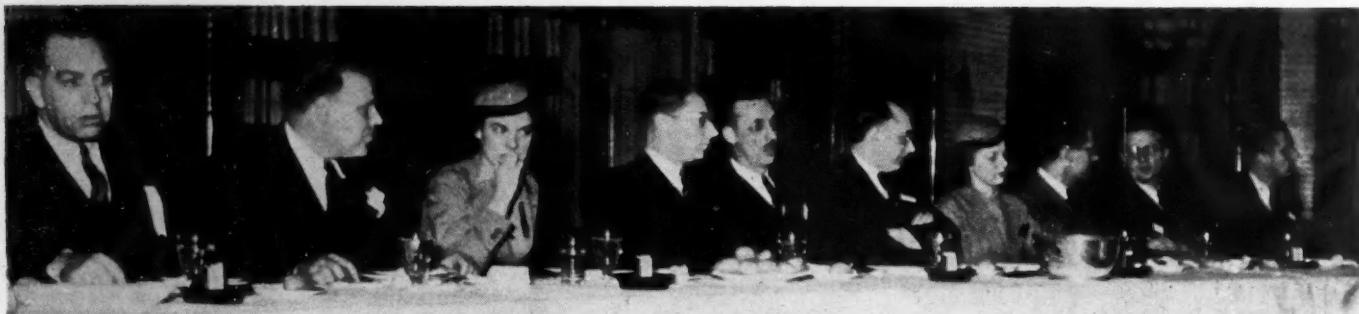
Bond Hotel, Hartford, Conn.

Syracuse - No meeting

Washington - April 11

Cosmos Club, Washington, D. C.; dinner 6:30 p.m. Plastics - Gordon Brown, sales manager, Bakelite Corp.

Stewardesses Join Engineers as Giant Airliners Are Previewed



Two United Aircraft stewardesses graced the speakers' table at the Metropolitan Section's Feb. 16 meeting on "Super Aircraft." Left to right are: R. M. Cregar, treasurer of the Section; S. G. Tilden, past-chairman; Miss Sue Nelson; A. T. Gregory, vice-chairman, aeronautics and chairman of the meeting; G. A. Page, Jr., speaker; M. C. Horine, Section chairman; Miss Billie Naylor; Albert C. Reed, speaker; T. P. Wright; and T. L. Preble, secretary. (Photo by Leslie Peat.)

Experts Present Data on Latest Transport Planes

● Metropolitan

Two of the latest and largest overland air transports were all but flown before 300 members and guests at Metropolitan Section's Feb. 16 meeting. A paper on "DC-4 Flight Tests," written by Albert C. Reed, flight research engineer of the Douglas Aircraft Co., was read by Arnold Kuethe, associate editor of the *Journal of the Aeronautical Sciences*, and "Transport Airplane Development," with particular reference to the Curtiss-Wright 20 was explained by George A. Page, Jr., chief engineer, St. Louis Airplane Division of Curtiss-Wright Corp. Motion pictures and slides were shown, and discussion by T. P. Wright, E. L. Allen, Charles Froesch and others, followed.

That the new DC-4 is superior to the DC-3 in many respects was shown by Mr. Reed in a series of charts. "There can be little question that the DC-4 from the point of view of dollars and cents is a very definite improvement for longer ranges," said the author, adding, "The DC-4 day plane operates at lower cost per 200-lb-mile than the DC-3 at ranges above 400 miles, while the sleeper arrangement is even better for all ranges. The DC-4 may be operated at a profit as a day plane for less than five cents per 200-lb-mile with 50% payload factor and as a sleeper for about five cents."

In a discussion of the tricycle landing gear of the DC-4, Mr. Reed stressed the need for brakes and brake-system reliability. Flush rivets and butt joints have resulted in a 15% reduction in parasite drag and 5% increase in high speed, he said.

In outlining the development of a typical transport airplane, Mr. Page, the second speaker, used as an illustration the CW-20 under construction by Curtiss-Wright Corp. Aerodynamic refinement has been a major consideration with a view to improved operating costs through increase of performance without additional power, said Mr. Page—for powerplant it was decided that two engines of high output would give the maximum in operating efficiency and while units rated at 1350 hp each have been selected, provision is made for later installation of 2000-hp engines.

Unusual cargo capacity has been provided in the CW-20, said Mr. Page, with 750 cu ft of space available for 600 lb of mail and express. Large doors make cargo compartments easily accessible for loading from the ground. Other features explained included power boosters on flying controls, simplification of instrument boards and incorporations of a "Tell-Tale" panel, wing and flap arrangement, full-feathering propellers, and improved landing gear. Provisions have been made to pressurize the CW-20 cabin to give 7000 ft relative altitude at the 25,000-ft level.

In conclusion Mr. Page noted that "nearly 4000 drawings are required to record the CW-20 design for production purposes and the engineering work alone has occupied 100 men for over two years."

Reports Bearing Wear Advances

The war on bearing wear was covered by correspondents in two reports given at the meeting of Metropolitan Section, March 9 at Hotel New Yorker—Dr. F. L. Miller, assistant director of the Standard Oil Development Co.'s Esso Laboratories, spoke for the lubrication forces and A. F. Underwood of General Motors Research Laboratories Division presented data for the engine manufacturers.

Car and engine tests on bearing wear, Dr. Miller reported, were first made with chassis dynamometer,* but later this method was discontinued in favor of engine dynamometer testing. He told about use of the Underwood corrosion test, and correlation of engine and Underwood test data. He summarized factors affecting bearing corrosion, the mechanism of the reactions involved and in closing, outlined results obtained.

Mr. Underwood, as representative of the engine makers, urged continued attack on the corrosion problem by both bearing manufacturers and oil experts. He told how his accelerated corrosion test is used in place of unreliable engine and car tests. He explained the characteristics of various bearing alloys and the efforts made to prevent acid pitting by addition of tin, antimony, cadmium and \$450-per-lb indium.

The speaker outlined efforts made to improve copper-lead bearings and commented on the recent introduction of silver for aircraft bearings.

"The outlook for the future is that better bearings will be made," said Mr. Underwood. "These bearings will not be subject to the corrosive attack of any oil. They will have a satisfactory life and antifriction properties at loads even up to 5000 lb per sq in."

Future Transoceanic Airliners Pictured

● Syracuse

That flying boats of 500 or even 1000 tons carrying several thousand passengers could be successfully designed and built, is the belief expressed by Igor I. Sikorsky, Sikorsky Aircraft Division, United Aircraft Corp., before the Jan. 30 meeting of the Syracuse Section. It is his opinion, however, that a larger number of ships of from 100 to 250 tons with more frequent departures will render better service and will remain the background of the intercontinental flying fleet during the next 25 years.

Mr. Sikorsky pictured the 100-ton transoceanic flying boat as a prospect of the immediate future, and stated:

"Within a few years passengers will travel to Europe on such ships that will cross the Atlantic in less than 20 hr. The flight will be luxurious and pleasant. There will be some 50 comfortable staterooms, a large dining salon that will be used for dancing or games in the evening, promenade decks, smoking lounges, a library, comfortable living quarters for the crew, and in general most of the accommodations and luxury items found on board a first-class yacht, except a swimming pool.

"The design of such ships," he continued, "would include many novel engineering problems. The manual power of the pilot would be inadequate to operate the control surfaces of the 10,000-hp flying ship. Therefore, the controls would have to be operated mechanically. Powerful engines, as well as numerous auxiliary mechanisms, would be located inside of the huge wings in special engine rooms under the supervision of mechanics. There would be a supercharging plant, an electric powerplant, and a heating plant to maintain comfortable temperatures while the ship is cooled by the 200 to 250 mph wind while flying at -60 F in the stratosphere."

Such problems, Mr. Sikorsky added, are now routine engineering work and solutions to some of them already have been found.

Describes Distinctive Features of GM Diesel

● Baltimore

"A modern internal-combustion engine, quite similar in general make-up to the heavy-duty automotive engine, making use of the various well-accepted principles of compression-ignition or diesel-engine construction, which are generally understood and accepted today," was W. A. Maynard's introduction to the General Motors 2-cycle diesel engine in his paper before the Baltimore Section's March 3 meeting, discussing it from the operators' point of view.

Mr. Maynard, who is sales promotion manager, Cleveland Diesel Engine Division of General Motors Sales Corp., went on to say, "The engine, however, includes various constructional features which are distinctive and have a very important bearing on the general make-up of the engine and on its operating characteristics." He spoke particularly of the development of oil-cooled pistons suitable to automotive speeds and sizes, and a unique injection system which provides sufficiently high injection pressures to insure adequate atomization of fuel for proper burning of various commercially available fuels under a wide range of operating conditions.

The diesel engine, Mr. Maynard noted, has higher maximum explosion pressure than the conventional gasoline engine and when using normal materials and construction methods, a weight handicap is imposed upon it. "The 2-

cycle diesel engine, however," he continued, "makes possible the development of the same power output from a smaller displacement cylinder—materials, construction methods, factors of safety, and rotative speed remaining the same—with the result that it is competitively comparable with the 4-cycle gasoline engine using the same materials and production standards." As an example he noted that the 6-cyl Model 6-71 General Motors 2-cycle automotive type diesel engine is actually lighter than a current model 4-cycle gasoline engine built by another division of the same corporation.

Mr. Maynard devoted a section of his paper to exploding the belief of some operators that sticking piston rings is a problem inseparable from the diesel engine. He explained how this has been overcome by better temperature control through the use of oil-cooled pistons and by redesign of the piston assembly to provide a convenient path for heat transfer from the piston head to the piston wall, without involving the piston rings.

In concluding, the author set forth the thought that as diesel engines are now, for the first time, being manufactured on a competitive production basis, it may logically be expected that the future will bring refinements and improvements which will still further increase the comparative advantages of the automotive 2-cycle diesel engine with respect to its 4-cycle gasoline contemporary.

Advances in Car Heaters And Carburetors Noted

● Chicago

"Factors Affecting the Air-Conditioning Design of Vehicles," by E. L. Mayo, vice-president, Bishop & Babcock Mfg. Co., and "Highlights of Carburetion," by W. A. Gebhardt, Stromberg Carburetor Division of Bendix Products, comprised the instructive diet served to 121 members and guests of the Chicago Section at its Feb. 7 meeting. As chairman of the technical session, J. T. Greenlee, Imperial Brass Mfg. Co., introduced the speakers and presided over the discussion which followed.

To provide adequate heating for temperatures as low as 10 deg below zero in the modern motor car, Mr. Mayo, the first speaker, pointed out that a minimum of 10,000 Btu per hr is essential. Continued improvement in car heating devices, he said, is indicated by the fact that only three years ago a heating device with an output of 5000 to 6000 Btu per hr was considered satisfactory. Delivery of air should not be less than 150 to 250 cfm at suitable velocity at discharge temperature, he declared.

Use of car velocity to supplement mechanical devices for introducing air, and a composite design of heater and defroster, were suggested by the speaker as a means of reducing wattage consumption, which consumption in recent years, he pointed out, has grown from 30 w to as high as 55 or 60. For defrosting and de-icing the minimum requirements, he said, are about 2000 Btu delivered with 35 to 40 cfm against the windshield glass. Better standards for supplemental heating of the windshield will tend to facilitate better design. Likewise objectionable noises in heating devices should be reduced and to this end, Mr. Mayo stressed, standards should be established which should specify in decibels the maximum noise permissible.

Perhaps the most serious defect in heating devices today, it was contended by the speaker, is lack of uniformity in distributing heat equally in the car. Temperatures of 70F in the front compartment and the rear-roof section are common when at the same time rear floor temperatures are as low as 40F. A concerted effort is needed to remedy this situation, Mr. Mayo said.

Discussing humidity, he said that this is a most acute problem in the winter, since doors

and windows are usually closed and each passenger introduces $\frac{1}{4}$ lb of moisture per hr into the car. For controlling this humidification, the use of air from an outside supply offers many advantages, Mr. Mayo pointed out. It insures adequate oxygen supply for passenger comfort and for removal of fumes and odors. It reduces relative humidity. It builds up static pressure in the car and decreases entrance of cold drafts through the door and window openings. It reduces the tendency to fog glass areas. Under mild conditions, through car velocity and outside air around the heating core, it can provide heating without use of fan and motor. It serves, also, the speaker said, to develop high operating efficiency, as with outside air introduced by car velocity, heater air input is increased and the core heating efficiency is raised.

Discussing controlled cooling, Mr. Mayo said the average car operating in the northern zone requires cooling equipment with a capacity of not less than 21,000 Btu per hr to provide for leakage and infiltration losses at a speed of 60 and 65 mph. Compressors for this purpose can be built, the speaker said, with the weight not in excess of 32 lb. With the compressor type system, he noted, a supplemental heating coil can be incorporated into the evaporator design and through the fan of this unit, a change can be made in the air distribution system from cooling to heating, the operation being controlled from the dash. With such a system weighing about 180 lb, Mr. Mayo declared, the temperature can be dropped 15F to 18F within 10 min and humidity reduced from 75% to 40% within 4 min at normal driving speeds with 4 passengers in the car.

The second speaker, Mr. Gebhardt, pointed out that carburetor complaints are to be expected in present-day car performance, considering that production carburetor settings are specified on the lean edge. Between summer and winter operation, he said, a 4% variation prevails in metering jet capacity, and production carburetors at his company's South Bend plant are held to a variation of 6%. Other variations or tolerances total 16%, or an equivalent of $2\frac{1}{2}$ mpg on a normal 15 mpg basis. However, these variations result in only about $1\frac{1}{4}$ mpg difference by reason of engine characteristics, he added.

A case was cited of a sharp backfiring and muffled pops in the carburetor of a new model which incorporated engine changes. After tests at various speeds and throttle openings, the speaker said, it was found that altering the idle system so as to require a slightly richer initial idle setting relieved the situation.

Names Carburetor Evil

One carburetor evil termed "throttle distribution" is that of a "flat feeling" at certain part-throttle openings under load, Mr. Gebhardt said. He added that research directed towards obtaining improved diffusion of fuel through the air stream, previous to the throttle, has been most fruitful in eliminating the trouble.

In conducting a research test seeking the greatest possible economy in a carburetor, he reported, a set-up was devised consisting of a spray nozzle, and fuel under pressure; tests being made at motor speed of 1600 rpm. The gain in economy over the conventional type carburetor, the speaker declared, was about 21%, after which the question was asked, how much increase in cost does this gain warrant?

Heralding the automatic choke development and its efficiency during warm-up periods, as the outstanding development of the past five years, the author called attention to a modified choke recently developed in which a small electric coil heating element operated by the ignition switch is used instead of a manifold heat.

In cases of difficult starting after a hot run, when fuel-pump pressures jump as high as 15 lb per sq in., spillage occurs, flooding the manifold, it was said. The remedy, Mr. Gebhardt pointed out, is to shield the carburetor and fuel line from as much heat as possible. To over-

come cutting off of the carburetor on highway curves and on deceleration, a result precipitated largely by balloon tires and new spring suspensions, the aero-type carburetor was evolved, the speaker said, illustrating by slides its design and baffle construction. He showed how the damping action prevents missing of the carburetor, for example, on 90 deg curves, and how stalling is prevented when the car is brought to a quick stop.

Supercharger Efficiency Analyzed by Prof. Paul

● Northwest

Delving into the subject of "Forced Induction for Automotive Vehicles," Prof. W. H. Paul, department of mechanical engineering, Oregon State College, spoke before 75 members and guests attending the Northwest Section's Feb. 10 meeting.

After analyzing the types of superchargers and devoting a portion of his paper to theoretical considerations, Prof. Paul gave some data on actual performance of supercharged engines.

Separately driven superchargers on relatively large truck engines have shown interesting performance results, Prof. Paul revealed. Reports on the performance of one truck engine equipped with a supercharger driven individually by a 12-hp Austin motor, the truck covering 30,000 miles over mountainous country, indicate that the power of the engine could be increased 70 to 75% and the fuel economy, 12 to 15%; power increases being sufficient to permit operation from one to two gears higher on hills with a 21-ton payload. Time saving was 18%, and no mechanical difficulties were encountered, Prof. Paul told the meeting.

Focusing his theoretical analysis of supercharged and unsupercharged cycles on a comparison of their efficiency and capacity, Prof. Paul concluded that "forced induction holds nothing alluring from the standpoint of increased efficiency. Let us say, rather, that it will do as well as the unthrottled cycle."

From the standpoint of mean effective pressure or power output, however, a 48% increase is indicated for the supercharged cycle, Prof. Paul explained. He summarized his comparison with the statement that "for the same volumetric compression ratio, same clearance volume, the supercharged engine is capable of producing considerably more power with no sacrifice in thermal efficiency."

In his discussion of supercharger types, Prof. Paul contrasted centrifugal, Roots, and vane types, as well as the various methods of mounting and driving them. Centrifugal superchargers, he said, have the advantage of being quiet and easy to silence; their construction is simple and their cost low. Comparing the Roots with the centrifugal type, he showed that the Roots type compresses a greater quantity of air at the lower speeds, but requires considerably more power to drive it at the higher outputs. Vane superchargers, he reported, have been used mostly on European aircraft engines, and the power necessary to compress a given quantity of air lies somewhere between that for the Roots and the centrifugal blowers. The necessity for lubricating the vanes was given as a disadvantage of this type.

Traces Development Of Electric Clutch

● Milwaukee

The design, operation, and application of the electric clutch were fully covered by Martin Winther, The Dynamatic Corp., in his talk on "New Methods of Power Transmission," delivered at the Feb. 10 meeting of the Milwaukee Section. A dinner was held prior to the technical session. Total attendance of members and

guests reached 100 and included engineers from several plants manufacturing electric motors.

The speaker traced the design of the electric clutch from its inception up to the present time, recalling the difficulties encountered in the early stages of the development and the methods used to overcome them. Many charts and slides were used by the speaker to illustrate his points.

Electric clutches are at present used on compressor-drives on Pullman cars, electric motor brakes, oil-filled equipment, and marine drives, Mr. Winther said.

Reveals Cabin Details Of New Transport Plane

● Detroit

The two-year job of designing a new type of transport plane was outlined for Detroit SAE members by George A. Page, Jr., at the Feb. 27 meeting. Mr. Page is chief engineer of the St. Louis Airplane Division, Curtiss-Wright Corp. An aviation enthusiast since 1910, he has been with the original Curtiss company and Curtiss-Wright since 1917.

Discussing the new CW-20, which in normal day operation will carry 30 passengers, he revealed that the cabin is pressurized and at altitudes up to 25,000 ft will maintain atmospheric conditions equivalent to those at 7000 ft. Questioned about the weight penalties paid, he said that about 400 lb is required in addition to the normal fuselage shell structure weight, and that added equipment for supercharging the cabin amounts to 600 lb. The gross weight of the airplane is approximately 36,000 lb with a payload of 11,500 lb.

Important safety features incorporated include a one-third reduction in the number of instruments which the pilot is required to watch in multi-motor operation, a new "Dubl-Check" system of instrument panel lights which warn the pilot when any phases of the operation are not correct for the existing flight conditions, and a hubless, spokeless control wheel which gives full and easy vision of the instrument panel.

Among other details which he described was the cabin heating system which operates independently of the powerplants and consists of a gasoline-burning heater similar to those being used on automobiles. It consumes $3\frac{1}{2}$ gal of fuel per hour and two units are used to provide enough heat to maintain a comfortable cabin temperature, even when outside temperatures are as low as 40F below zero.

Mr. Page was introduced by SAE Past-President William B. Stout, toastmaster, who explained the changes in thinking which preceded the design of large transport planes. A few years ago, he said, it was assumed that the larger airplanes would be less efficient than small ones. The converse has proven to be true. Epigrammatically he said in his introduction: "Thinking starts—and sometimes ends—with the selection of assumptions."

Ralph Upson, Section vice-chairman of the aeronautic activity, was chairman of the meeting.

Data on Flame Propagation

Engine designers in the Detroit Section were brought up to date on the subject of "Flame Propagation and Pressure Development" when Dr. G. M. Rassweiler, research physicist, GM Research, addressed the meeting on Feb. 6. Introduced by Tore Franzen, Dr. Rassweiler elaborated on the project which was started years ago by C. F. Kettering and on which Dr. Lloyd Withrow started work in 1926. He reviewed the material presented by Dr. Withrow at the Annual Meeting last winter and explained again, briefly, the three pieces of instrumentation which have made this combustion study possible—the quartz glass top engine, the high-speed moving picture camera and the pressure indicator used in conjunction with the camera.

All of the engine explosions shown in previous presentations of this material were under the same conditions. Dr. Rassweiler explained that this work has been extended to other engine conditions, all, however, outside of knocking range.

One of the interesting innovations revealed was the use of sodium in the combustion flame to brighten up the images. Questioned about apparent flame fronts, Dr. Rassweiler explained:

"I might say that in some of these pictures when we added sodium to the flame, you can see the first part of the flame propagation (immediately after the spark) and you can see the flame partly, right after ignition. In those pictures we feel we very probably show the forward edge of the flame."

Among the indications furnished by some of the slides is the fact that on two comparable explosions, the end of the combustion (completion) may occur at quite different times. In the case under consideration, Dr. Rassweiler pointed out that the completion of one explosion was delayed about 12 deg after the completion of an explosion on another slide. He judged from this that the flame propagation was a little faster in one case than in the other. In spite of that, he said, the maximum pressure was developed at approximately the same angle in each case. He pointed out that the rapid-burning charge develops a maximum pressure of 370 lb per sq in. as compared to 348 lb per sq in. for the slow-burning charge. Numerous comments and questions arose after the presentation of the formal paper. T. A. Boyd, head, fuel department, GM Research, pointed out that the aim and effort in all of this work has been confined to an attempt to get dependable data. "No theorizing, or substantially no theorizing, has been done," he emphasized.

The paper was the result of a joint effort on the part of Dr. Rassweiler, Dr. Withrow and Walter Cornelius, all associated with the General Motors Research Laboratories.

150 Hear Davidson Review Diesel History

● Canadian

One hundred and fifty members and guests of the Canadian Section crowded the Tudor Room of Toronto's Royal York Hotel, Feb. 15, to welcome Canadian born, bred, and educated SAE President William J. Davidson, who had come from Florida to be guest-of-honor speaker. Section Chairman C. E. Tilston presided at the meeting, and Alex Gray was host at the reception which preceded the dinner.

Introduced by a former colleague at General Motors of Canada, Norman H. Daniel of the engineering staff, Mr. Davidson spoke on "Diesel Engines." He gave a non-technical sketch of the diesel's evolution from the time of its invention as a coal-dust burner by Dr. Rudolph Diesel to its manifold forms of today. The English descriptive title, "compression-ignition engine," is probably best, he stated, arguing that there is no better reason for describing the compression-ignition engine as "Diesel," than there is for designating the turbine as the "Parson," the reciprocating steam engine as the "Watt," or the gasoline engine as the "Otto," or the "Daimler," or the "Benz."

The speaker noted that during the year in which Gottlieb Daimler drove a boat and a cycle with his adaptation of the Otto-cycle engine for the combustion of gasoline, Carl Benz developed electric-spark ignition, and Akroyd Stuart, in England, built a fuel-injection pump for a stationary engine as a means of controlling the point of ignition. Stuart, he continued, found that by increasing the compression ratio of his engine he could dispense with the heating lamp he had employed, except for cold starting. Stuart's engines, he explained, were being produced in England, when Diesel developed his engine for the use of coal dust as

fuel. He also noted that in the 1870's, Priestman, Hornsby-Akroyd, and others did considerable experimental work on compression-ignition engines.

Mr. Davidson briefly described the various types of 2-cycle diesel engines being produced by General Motors. The superiority of the diesel-electric railroad locomotives over steam locomotives, he said, is that the latter "cost importantly more to operate for importantly less service." The high availability of the diesel-electric, its freedom from the steam locomotive's tendency to "nose," and its highly variable starting torque, were among the advantages listed for this type of locomotive.

St. Louis Birthplace of American Diesel Engines

● St. Louis

St. Louis Section members learned at their Feb. 24 meeting that the first diesel engine to be built in America and the first in the world to operate in commercial service was built in their city in 1898 and was installed in the Anheuser-Busch Brewery. This was revealed by L. D. Calhoun, design engineer of Busch-Sulzer Diesel Engine Co., in his talk on the early development of the diesel engine in the United States.

Soon after Dr. Rudolph Diesel brought his engine to the attention of the world in 1897, Mr. Calhoun stated, Adolphus Busch met with him and contracted for control of all Dr. Diesel's existing and future patents in the United States, its possessions and Canada. He soon after organized the company which has become the Busch-Sulzer Diesel Engine Co., Mr. Calhoun noted.

The speaker then pointed out the numerous design changes that have been made since the early days, including: transition from open to closed crankcases; from air to solid injection; from piston to rotary scavenging pumps; from 4-cycle to 2-cycle operation; and from water-cooled to oil-cooled pistons. He likewise showed slides of engine cross-sections and of steps in the manufacture of typical diesel engines.

At the close of the discussion following Mr. Calhoun's paper, Section Chairman Adam Ebinger introduced J. E. Jury, Shell Petroleum Corp., who spoke on the objectives of his company in preparing a series of pamphlets entitled "Panorama of Lubrication." Its aim, he stated, is to educate the layman in some of the fundamentals of lubrication, and he emphasized the difficulty of interpreting technical information in a language which would be intelligible to the "man on the street," especially when dealing with a subject upon which the experts disagree.

Following Mr. Jury's talk two motion pictures, "Steel, Man's Servant," and "Corten," were shown through the courtesy of the United States Steel Corp.

Standards Committee on Rubber Products Planned

Plans are under way to organize an SAE advisory committee on standardization of rubber products to cooperate with the American Society for Testing Materials' Committee D-11 on Specifications for Tests and Test Procedure of Rubber Products, and later to foster dimensional standardization within the SAE.

This step reflects the industry's increasing interest in the development of adequate standards for testing rubber products, for material specifications, and for dimensional standards. The scope of the ASTM D-11 Committee, upon which the SAE has representation, is general and it is felt that more specific information is needed as to what the automotive industry desires in this field.